Water Resource Report 57

GROUNDWATER RESOURCES OF THE LOWER SUSQUEHANNA RIVER BASIN, PENNSYLVANIA

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Prepared by the Pennsylvania Geological Survey in cooperation with the Susquehanna River Basin Commission

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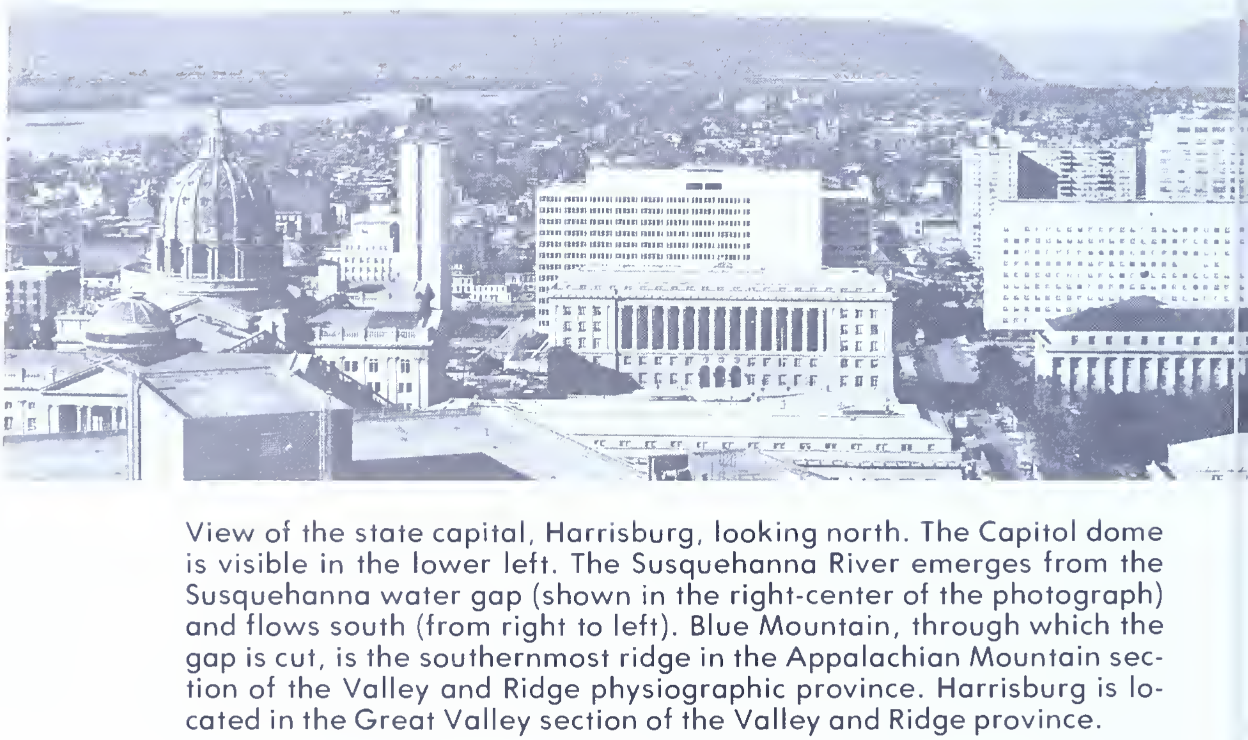

View of the state capital, Harrisburg, looking north. The Capitol dome is visible in the lower left. The Susquehanna River emerges from the Susquehanna water gap (shown in the right-center of the photograph) and flows south (from right to left). Blue Mountain, through which the gap is cut, is the southernmost ridge in the Appalachian Mountain section of the Valley and Ridge physiographic province. Harrisburg is located in the Great Valley section of the Valley and Ridge province.

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ABSTRACT

The Lower Susquehanna River basin has abundant water resources resulting from a yearly average of approximately 40 inches of precipitation. About 45 percent (18 inches) runs off the land surface directly as overland runoff and streamflow. Roughly 25 percent (10 inches) is recharged to the groundwater system and eventually provides the baseflow to streams, and the remaining 55 percent (22 inches) is lost to evapotranspiration.

Groundwater use was estimated to be about 127 million gallons per day in 1970. Even considering projected increases in use, only a small fraction of the total available resource is being utilized.

The aquifers in the basin are extremely diverse with respect to rock type and structural setting. Most rock units yield sufficient quantities of water to wells for domestic use. Geologic and topographic criteria must be used to locate larger supplies.

The mean recharge to the groundwater system ranges between 215 and 520 gallons per minute per square mile. The lowest values are for the metamorphic rocks in eastern Lancaster and western Chester Counties. The highest recharge is to the carbonate rocks of the eastern Great Valley.

Groundwater quality is generally adequate for most uses. The most troublesome natural constituents in groundwater are iron and manganese; more than 33 percent of the analyzed samples had concentrations that exceeded the recommended limit of the U.S. Environmental Protection Agency for one or both of these constituents.

Major types and sources of groundwater contamination in the basin are bacterial organisms and nitrates from on-lot sewage systems, acid mine drainage, excessive nitrates from agricultural activities, hydrocarbons from buried storage tanks and industrial processes, chlorinated solvents from degreasing operations, and leachate from landfills.

INTRODUCTION

PURPOSE AND SCOPE

This report is one of four prepared by the Pennsylvania Geological Survey as part of the three-year Special Groundwater Study of the Susquehanna River basin by the Susquehanna River Basin Commission in cooperation with various state and federal agencies. The respective areas covered by the reports are shown in Figure 1.

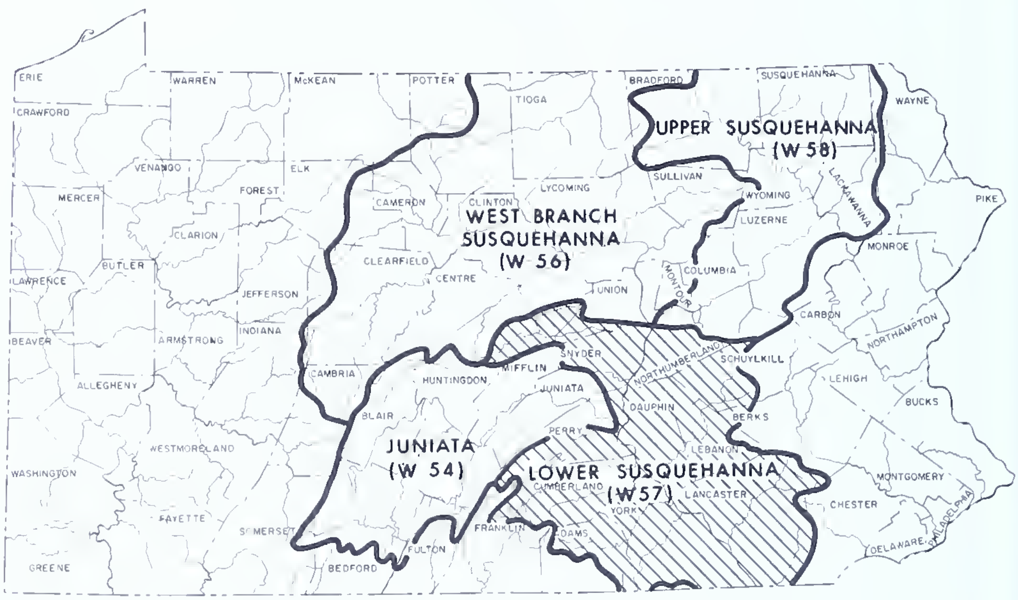

Figure 1. Location of the Pennsylvania portion of the Susquehanna River basin, the Lower Susquehanna River basin, and the three additional report areas.

The reports are designed to make the large volume of data collected during the comparatively short duration of the project available to the public as rapidly as possible, and as a result they contain only a minimum of interpretation. This up-to-date information and data on the quantity and quality of groundwater within the report areas should assist in the optimum development and utilization of the resource and form the basis for detailed investigations to follow.

The part of the basin south of Blue Mountain has been the subject of numerous groundwater investigations (Blue Mountain forms the approximate northern boundary of the Great Valley section shown in Figure 3). The areas covered by the respective studies are shown in Figure 2 and the titles are listed in Table 1. Additionally, a regional numerical flow model of the southern basin and a detailed numerical flow model for part of Lancaster County were prepared by the U.S. Geological Survey as a part of the Special

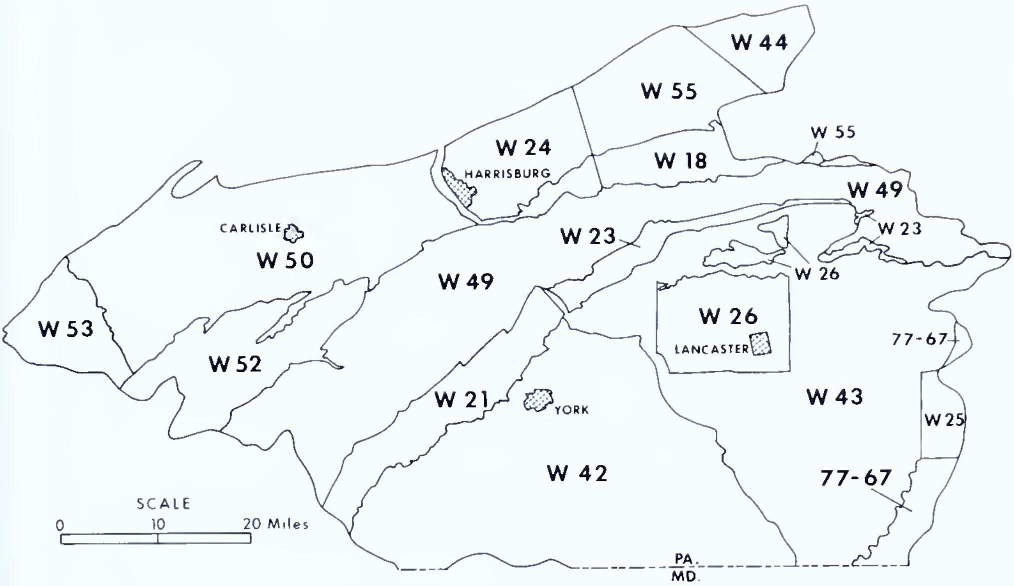

Figure 2. Areas covered by detailed groundwater studies in the Lower Susquehanna River basin.

Table 1. ***Groundwater Investigations in the Lower Susquehanna River Basin***

(See Figure 2 for locations and see reference section (p. 87) for complete bibliographic information)

Pennsylvania Geological Survey Water Resource Report number	Title
W 18	Hydrogeology of the Carbonate Rocks of the Lebanon Valley, Pennsylvania
W 21	Hydrology of the New Oxford Formation in Adams and York Counties, Pennsylvania
W 23	Hydrology of the New Oxford Formation in Lancaster County, Pennsylvania
W 24	Geology and Hydrology of the Martinsburg Formation in Dauphin County, Pennsylvania
W 25	Hydrology of the Metamorphic and Igneous Rocks of Central Chester County, Pennsylvania
W 26	Hydrogeology of the Carbonate Rocks of the Lancaster 15-Minute Quadrangle, Southeastern Pennsylvania
W 42	Ground-Water Resources of Central and Southern York County, Pennsylvania
W 43	Summary Ground-Water Resources of Lancaster County, Pennsylvania
W 44	Geology and Groundwater Resources of Northern Berks County, Pennsylvania
W 49	Groundwater Resources of the Gettysburg and Hammer Creek Formations, Southeastern Pennsylvania

Table 1. *(Continued)*

Pennsylvania Geological Survey Water Resource Report number	Title
W 50	Groundwater and Geology of the Cumberland Valley, Cumberland County, Pennsylvania
W 52	Summary Groundwater Resources of Adams County, Pennsylvania
W 53	Groundwater Resources in the Cumberland and Contiguous Valleys of Franklin County, Pennsylvania
W 55	Summary Groundwater Resources of Lebanon County, Pennsylvania
77-67[a]	Ground-Water Resources of Chester County, Pennsylvania

[a] U.S. Geological Survey Water Resources Investigations number.

Groundwater Study (Gerhart and Lazorchick, in preparation). Because this part of the basin has been covered in detail by prior studies, much of the emphasis in the report that follows is on the region to the north of Blue Mountain.

LOCATION AND DESCRIPTION OF THE AREA

The portion of the Susquehanna River basin covered by this report drains an area of about 5,606 square miles in south-central Pennsylvania. All or most of Cumberland, Dauphin, Lancaster, Lebanon, Snyder, and York Counties, along with parts of Adams, Berks, Centre, Chester, Columbia, Franklin, Juniata, Northumberland, Mifflin, Perry, Schuylkill, and Union Counties are included.

The northern part of the area is mountainous, consisting of a series of roughly northeast-southwest trending ridges. South of Blue Mountain the terrain consists predominantly of gently rolling lowlands. South Mountain, which has a maximum elevation of about 2,100 feet, interrupts this lowland in Adams and Cumberland Counties. Because of this contrasting topography and geology, the region has been subdivided into six physiographic units as shown in Figure 3.

Several important industrial centers having populations in excess of 20,000 are located within the basin. They are, in order of decreasing population, Harrisburg, Lancaster, York, Lebanon, and Carlisle. Harrisburg, the state capital, also has a significant population employed in government-related activities. Agriculture is an important economic activity throughout the rural parts of the basin. Population totals by county are given in Table 2. The overall land use within the Lower Susquehanna River basin is shown in Figure 4. Although this is the most populous region within the Susquehanna River basin, only 8 percent of the land can be classified as urban or built-up, which attests to the rural nature of this locale.

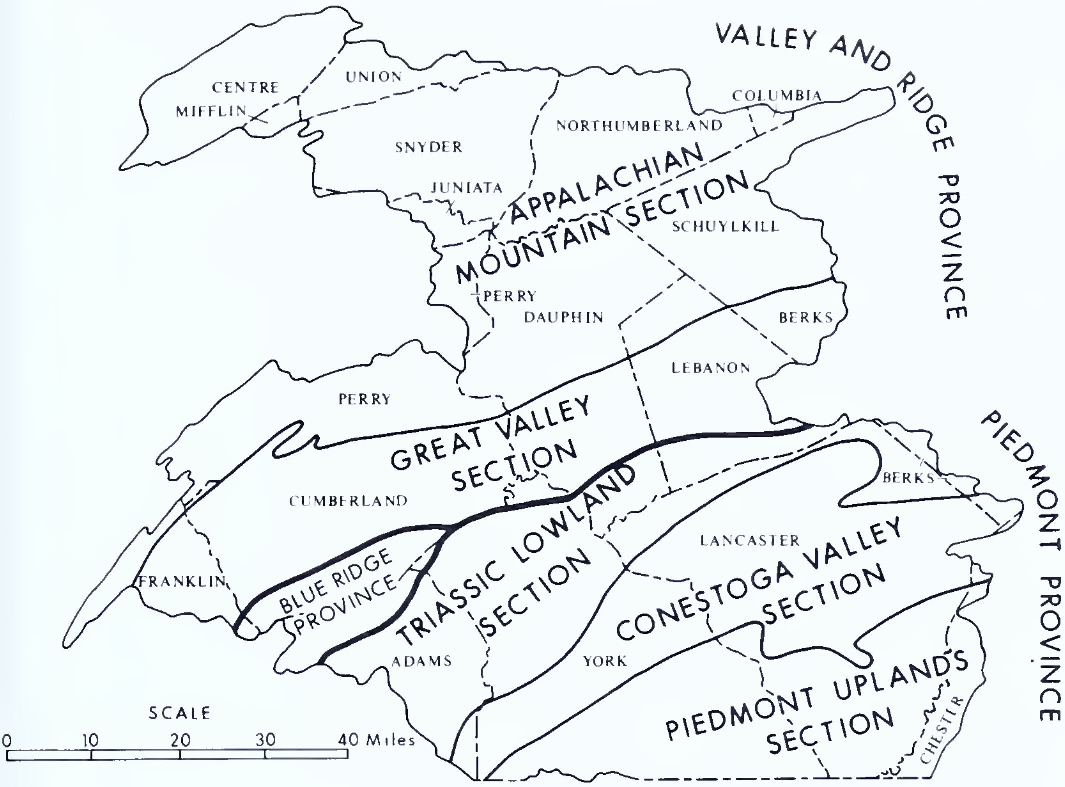

Figure 3. Physiographic provinces and sections in the Lower Susquehanna River basin.

Table 2. *County and Basin Population Totals and Projections for the Lower Susquehanna River Basin*

(Modified from Pennsylvania Department of Environmental Resources, 1980a, b)

County	1970	1990	Percent increase
Adams	57,053[a]	67,941	19.1
Centre	99,601	123,027	23.5
Cumberland	158,500	196,618	24.0
Dauphin	224,101	256,803	14.6
Lancaster	320,818	379,085	18.2
Lebanon	99,861	116,345	16.5
Northumberland	99,270	104,107	4.9
Perry	28,681	31,864	11.1
Snyder	29,333	39,309	34.0
Schuylkill	160,089	183,939	14.9
Union	28,669	33,142	15.6
York	273,236	351,436	28.6
Basin totals	1,313,332	1,593,300	21.3

[a] Total for county even if only partly within the basin. Counties having a very small area in the basin are not listed.

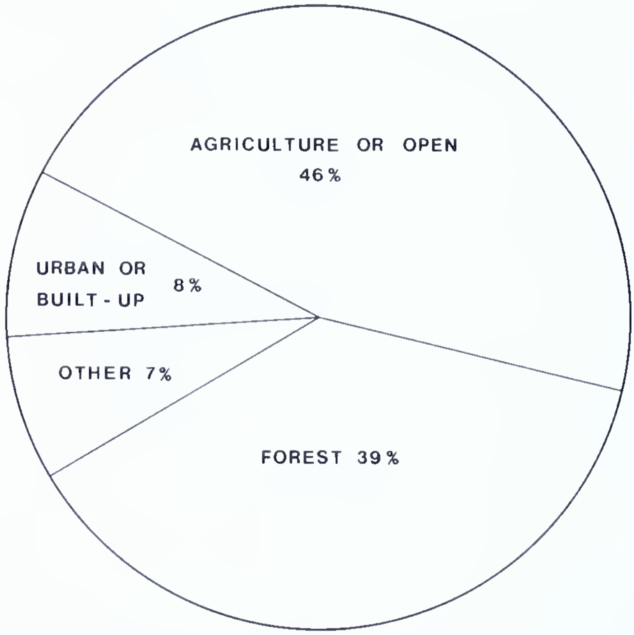

Figure 4. Percentage of land use by category (1974). Data are from Pennsylvania Department of Environmental Resources (1980a, b).

ACKNOWLEDGEMENTS

The writers are grateful to the many well owners who allowed their wells to be tested and sampled. The U.S. Geological Survey, the Susquehanna River Basin Commission, and the Bureau of Laboratories within the Pennsylvania Department of Environmental Resources provided valuable input and data to the project. James Gerhart of the U.S. Geological Survey supervised the collection of water-quality samples in the lower part of the basin and also provided valuable guidance in retrieving water-quality data from the U.S. Geological Survey's computerized data-storage system.

Valuable assistance in the field-data-collection phase of the project was provided by Mary Lou Kriz, Nancy S. duPont, and Philip J. Walsh, Jr., of the Susquehanna River Basin Commission.

WATER USE

Total water use in the Lower Susquehanna River basin was estimated to be about 1,762 Mgal/d (million gallons per day) in 1970 (Pennsylvania Department of Environmental Resources, 1980a, b). More than 1,400 Mgal/d represents surface-water use for power generation. About 36 percent of the remaining water use is obtained from underground sources. Mineral producers are the largest users of groundwater, followed by industrial, domestic, and public users, in that order (Table 3).

Table 3. Water Use for 1970 in the Lower Susquehanna River Basin
(Modified from Pennsylvania Department of Environmental Resources, 1980a, b)

	Withdrawals (Mgal/d)		
Type of use	Groundwater	Surface water	Total
Public supply	14.5	126.0	140.5
Domestic supply	25.4	0.0	25.4
Industrial	30.7	66.8	97.5
Mineral	40.1	10.1	50.2
Agricultural	12.0	18.2	30.2
Golf course	1.6	3.2	4.8
Institutional	2.3	1.6	3.9
Power	0.0	1,409.3	1,409.3
Totals	126.6	1,635.2	1,761.8

The major users of groundwater and their sources of supply are listed in Table 4, *Public Water Suppliers Utilizing Groundwater*, and in Table 5, *Industries Using More than 100,000 Gallons of Groundwater per Day.*

The Pennsylvania Department of Environmental Resources (1980a, b) has projected about a 13 percent per decade increase in water use from 1970 to 1990. A substantial portion of this increase will be supplied by groundwater because of its general high quality and widespread availability. Also, limitations have been placed on the use of surface water during low-flow periods, which often precludes expansion of the use of surface water where there is no upstream compensation.

About 32 percent of the groundwater presently used is withdrawn by mineral extraction and processing sites. The water is most often pumped from the quarry and discharged to a surface stream; thus the use is consumptive with respect to the groundwater system. A large proportion of this water is removed at relatively few sites, which has in some places caused severe, localized depressions on the water table. Table 6 is a list of quarrying operations withdrawing in excess of 100,000 gallons per day. Withdrawals of this magnitude can cause significant reductions in groundwater levels; however, this has not been shown to occur at most of the sites.

HYDROLOGY

The occurrence and interrelation of water in the atmosphere and on the land surface, in addition to the water in the subsurface, must be described and quantified in order to properly utilize and manage the groundwater resource. This interrelation between atmospheric water, surface water, and underground water is collectively called the hydrologic cycle and is shown diagrammatically in Figure 5.

Table 4. *Public Water Suppliers Utilizing Groundwater*

County	Water supplier	Groundwater sources[a]
Adams	Abbottstown Borough	5 wells (Ad–72, 95, 434); 4 springs
	Arendtsville Borough	2 wells (Ad–153, 154); 2 spring fields
	Aspers Water Company	3 wells (Ad–158, 159, 258); 13 springs
	Bendersville Borough	3 wells (Ad–160, 161, 259); 3 springs
	Keystone Water Company (Biglerville)	4 wells (Ad–164, 165, 166, 394)
	Charnita Water and Improvement Association	1 well (Ad–265)
	East Berlin Borough	3 wells (Ad–134, 135, 136)
	Lake Heritage Utilities, Inc.	2 wells (Ad–261, 262)
	Lake Meade Utilities, Inc.	2 wells (Ad–263, 264)
	New Oxford Municipal Authority	2 wells (Ad–83, 436)[b]
	York Springs Borough	3 wells (Ad–155, 156, 157); 1 spring
Berks	Caernarvon Township Water Authority	4 wells (Be–557, 560, 561, 562)
Centre	Aaronsburg Water Pipe Company	2 wells (Ce–138, 139); 1 spring
	Centre Hall Borough Water Department	8 wells (Ce–30, 31, 123, 124, 127, 128, 129, 130); 7 springs (standby)
	Madisonburg Water Works	3 springs
	Penn Township Water District	1 well (Ce–206)[b]
	Rebersburg Water Company	1 well (Ce–208); 1 spring
	Spring Mills Water Company	1 spring
	Woodward Water Company	2 springs
Chester	Borough of Oxford	5 wells (Ch–75, 526, 527, 2187,[c] 2189)
	Atglen Borough Water Department	2 wells (Ch–1061, 1062); 2 springs
Cumberland	Carlisle Barracks	1 spring
	Carlisle Suburban Authority	2 wells (Cu–814, 815, 816, standby)[b]
	Center Square Water Company	1 well (Cu–252)
	Forge Road Acres Water Company	1 well
	Grantham Water Company, Inc.	1 spring
	Huckleberry Land Association	1 spring
	Mechanicsburg Water Company	1 well (Cu–278); 1 spring[b]
	Mt. Holly Springs Borough Authority	1 well (Cu–396)[b]
	Newville Borough Water Authority	1 spring
	Shippensburg Borough Water System	1 spring[b]

	South Middleton Township Municipal Authority	2 wells (Cu–456, 807)
	Summerdale Water Company	2 wells (Cu–18, 662)
	White Hill Correctional Institute	1 well (Cu–287)[b]
	White Rock Water Company	1 spring
	Williams Grove Park Company	1 spring
Dauphin	B & J Water Company, Inc.	1 well (Da–489, standby); 1 spring
	Dauphin Consolidated Water Supply Company	3 wells (Da–387, 404, 683); 1 spring[b]
	Elizabethville Water Company	2 wells (Da–754, 756); 2 springs
	Gratz Water Company	1 well (Da–577); 2 springs
	Halifax Borough Water Department	4 wells (Da–758, 760, 762, 764); 6 springs
	Harrisburg International Airport	11 wells (Da–80, 81, 82, 83, 84, 85, 88, 90, 91, 92, 93)
	Linglestown Water Company	3 wells (Da–279, 281, 766)
	Loyalton Water Company	2 wells
	Middletown Borough Water Company	3 wells (Da–99, 386, 455)
	Millersburg Area Water Authority	7 wells (Da–22, 400, 454, 689, 691, 693, 695); 6 springs
	Penn National Turf Club	2 wells (Da–748, 750)
	Skyline Water Company	1 well (Da–752)
	Uniontown Water Company	3 wells (Da–31, 679, 681)
Juniata	Richfield Area Joint Authority	2 wells (Sn–209, 210); 6 springs
Lancaster	Acorn Water Works	2 wells (Ln–1591, 1592)
	Adamstown Borough Water Department	2 wells (Ln–1285, 1286)
	Akron Borough Municipal Water Works	4 wells (Ln–214, 1596, 1597, 1598); 1 spring
	Bainbridge Water Authority	3 wells (Ln– 55, 56, 57)
	Blue Ball Water Authority	3 wells (Ln–1131, 1283, 1603)
	Christiana Gravity Water Company	2 wells (Ln–1117, 1118); 8 springs
	Denver Water Department	1 well (Ln–1305); 14 springs[b]
	East Cocalico Township Authority	8 wells (Ln–1299, 1300, 1307, 1308, 1310, 1599, 1600, 1601)
	East Donegal Township Municipal Authority	1 spring
	East Hempfield Township Municipal Authority	5 wells (Ln–643, 1406, 1604, 1605, 1606); 1 spring
	East Petersburg Borough Authority	1 well (Ln–1607); 1 spring[b]
	Elizabethtown Water Company	4 wells (Ln–267, 1533, 1534, 1535)[b]

Table 4. *(Continued)*

County	Water supplier	Groundwater sources[a]
Lancaster (*cont.*)	Ephrata Borough	2 wells (Ln-1536, 1537); 4 springs[b]
	Leola Water Authority	7 wells (Ln-1407, 1408, 1409, 1610, 1611, 1612, 1613)
	Lititz Borough Water Works	6 wells (Ln-3, 4, 5, 6, 1594, 1595)
	Manheim Water Department	1 well (Ln-1617); 1 spring[b]
	Marietta Gravity Water Company	3 wells (Ln-20, 1608, 1609)[b]
	Masonic Homes	4 wells (Ln-123, 124, 186, 187)
	Millersville Municipal Water Authority	4 wells (Ln-570, 571, 1280, 1540)
	Millersville State University	1 well (Ln-1282)
	Mount Joy Borough Authority	2 wells (Ln-1538, 1539); 1 spring
	New Holland Borough Water Department	1 well (Ln-1291); 3 springs
	Northwestern Lancaster County Authority	1 well (Ln-1621)
	Rheems Water Company	3 wells (Ln-96, 1410, 1615)
	Rowenna Water Company	1 well (Ln-1602)
	Borough of Strasburg	14 springs
	Terre Hill Borough Water Department	4 wells (Ln-1297, 1298, 1303, 1593)
	West Cocalico Authority	2 wells (Ln-1405, 1614)
	West Earl Water Company	1 spring
	Western Heights Water Authority	3 wells (Ln-1618, 1619, 1620)
Lebanon	Annville Township Water Authority	3 springs
	Campbelltown Water Company	2 wells (Lb-798, 799); 7 springs
	Cornwall Municipal Water Authority	1 well (Lb-432); springs[b]
	Fredericksburg Water Authority	3 wells (Lb-442, 443, 444)
	Heidelberg Township Municipal Authority	4 wells (Lb-341, 342, 412, 1106)
	Hill Crest View Cooperative Water System	2 wells (Lb-509, 510)
	Keystone Water Company	Springs
	Mount Gretna Camp Meeting Association	2 wells (Lb-433, 794)
	Mount Gretna Heights Water Company	2 wells (Lb-434, 793)
	Myerstown Water Authority	4 wells (Lb-703, 704, 705, 1055)
	Newmanstown Water Authority	1 well (Lb-699); 1 spring
	Pennsylvania Chautauqua Utility Commission	3 wells (Lb-795, 796, 797)
	Quentin Water Company	3 wells (Lb-435, 436 (standby), 1055)
	Richland Water Works	4 wells (Lb-700, 701, 702, 1025); 1 spring
	Stoney Crest Estates	2 wells (Lb-1102, 1103)

	West Lebanon Water Company	2 wells (Lb-1104, 1105)
	Leon Zimmerman Water Company	3 wells (Lb-1108, 1109, 1110)
Northumberland	Dalmatia Water Company	3 wells (Nu-51, 234, 235)
	Excelsior Water Association	1 spring
	Herndon Municipal Water System	3 wells (Nu-231, 232, 233); 4 springs
	McEwensville Municipal Water Authority	1 well (Nu-248)
	Shamokin Fire Control Station	1 well (Nu-236)
	Trevorton Water Company	1 well (Nu-237)
	Turbotville Water Company	1 spring
Perry	Blain Water Company	2 wells (Pe-75, 76); 1 spring
	Bloomfield Borough Water Authority	1 well (Pe-78); 5 springs
	Duncannon Municipal Water Company	2 wells (Pe-603, 605); 2 springs
	Liverpool Municipal Authority	3 wells (Pe-607, 608, 609)
	Sunshine Hills Water Company	2 wells (Pe-77, 661)
Schuylkill	Ashland Borough	1 well (Sc-365); 4 springs
	Ashland State General Hospital	1 well (Sc-153)
	Hegins Township Water Authority	3 wells (Sc-286, 287, 323); 5 springs
	Keystone Water Company, Frackville District	4 wells (Sc-7, 8, 11, 526); 3 springs
	Mountain Water Authority of Joliett	2 wells (Sc-522, 523)
	Tower City Borough Authority	2 wells (Sc-326, 327)[b]
	Tremont Municipal Authority	1 well (Sc-371)[b]
Snyder	Beavertown Municipal Water System	2 wells (Sn-72, 206)[b]
	Freeburg Municipal Authority	2 wells (Sn-70, 71)
	Hillcrest Manor Mobile Home Park	4 wells (Sn-228, 229, 230, 231)
	Kratzerville Municipal Water Authority	1 well
	Kreamer Municipal Water Authority	2 wells (Sn-132, 133)
	McClure Municipal Authority	2 wells (Sn-89, 91); 1 spring
	Middleburg Municipal Authority	2 wells (Sn-203, 204)[b]
	Monroe Manor Water Company	4 wells (Sn-143, 146, 147)
	Penns Creek Municipal Water Authority	1 well (Sn-139); 1 spring
	Perry Township Municipal Authority	1 well (Sn-205); 1 spring
	Rolling Green Water Company	2 wells (Sn-144, 145)
	Selinsgrove Center	4 wells (Sn-18, 60, 61)
	Selinsgrove Municipal Waterworks	2 wells (Sn-137, 138)[b]
	Troxelville Water Company	1 well (Sn-207); 2 springs

Table 4. *(Continued)*

County	Water supplier	Groundwater sources[a]
Union	New Berlin Municipal Authority	2 wells (Un–59, 61)
York	Briar Water Company	2 wells (Yo–1127, 1128)
	Chanceford Manor Village	1 well (Yo–1124)
	Delta Municipal Waterworks	3 wells (Yo–237, 238, 239)
	Dillsburg Borough Authority	3 wells (Yo–828, 829, 830); 9 springs
	Dover Borough Water System	6 wells (Yo–130, 135, 150, 151, 152, 1125)
	Dover Township York County Authority	7 wells (Yo–9, 97, 832, 833, 1027, 1041, 1119)
	East Prospect Borough Water Department	2 wells (Yo–692, 694); 2 springs
	Franklintown Borough Municipal Authority	1 well (Yo–1134)
	Gleneagle Water Company	2 wells (Yo–848, 1132)
	Glen Rock Municipal Water Authority	2 wells (Yo–224, 275)[b]
	Hallam Borough Municipal Waterworks	1 well (Yo–1126, standby); 10 springs
	Heidelberg Water Company	1 well (Yo–1141)
	Jackson Township Water District #1	1 well (Yo–365); 1 spring
	Jefferson Municipal Waterworks	1 well (Yo–1129); springs
	Mid-Penn Waterworks, Inc.	1 well (Yo–364); 1 spring
	Mountainview Water Company	2 wells (Yo–1130, 1131)
	Newberry Water Company	5 wells (Yo–822, 823, 824, 825, 1118)
	New Freedom Municipal Waterworks	6 wells (Yo–226, 229, 231, 232, 233, 1117)
	New Salem Borough Water Company	3 wells (Yo–1138, 1139, 1140)
	Railroad Municipal Water	1 well (Yo–602); 1 spring
	Raintree Water Company, Inc.	1 well (Yo–1133)
	Redland Water Company, Inc.	2 wells (Yo–826, 827)
	Seven Valleys Municipal Waterworks	1 well (Yo–633); 7 springs
	Shrewsbury Municipal Waterworks	8 wells (Yo–416, 417, 418, 419, 420, 1120, 1121, 1122); 3 springs
	Stewartstown Water Company	4 wells (Yo–466, 467, 468)
	West Manchester Township Water Authority	7 wells (Yo–4, 5, 108, 1045, 1046, 1047, 1048)
	Windsor Municipal Waterworks	1 well (Yo–1123); 7 springs
	Wrightsville Water Supply Company	2 springs
	York Water Company	2 wells (Yo–77, 159)[b]

[a] Well numbers refer to those used on Plate 1 and Table 20. Where no well number is listed, the well data for that supplier were not readily available.
[b] Also have surface-water sources.

Table 5. *Industries Using More than 100,000 Gallons of Groundwater per Day*

County	Name	Groundwater sources[1]
Adams	Duffy-Mott Company, Inc.	5 wells (Ad-295, 296, 298, 299, 450)
	Knouse Foods Cooperative, Inc.	2 wells (Ad-357, 358)
	Musselman Fruit Products, Pet Inc., Biglerville Plant	9 wells (Ad-278, 281, 282, 283, 284, 285, 286, 287, 288)
Cumberland	Eaton-Dikeman and Company	1 well (Cu-422)
	Kimberly Clark Corporation	1 well (Cu-322)
Dauphin	Hershey Foods Corporation	9 wells (Da-435, 438, 439, 440, 442, 446, 451)
	Reese Candy Company	Quarry
Lancaster	Armstrong Cork Company, Marietta Ceiling Plant	1 well
	Dart Container Corporation of Pennsylvania	6 wells (Ln-1527, 1528, 1529, 1530, 1531, 1532)
	Empire Kosher Poultry Inc., Bird-In-Hand Plant	4 wells (Ln-1519, 1520, 1521, 1522)
	Fuller Company, Manheim Plant	1 well (Ln-1526)
	Raybestos-Manhatten Inc.	3 wells (Ln-1523, 1524, 1525)
	Victor F. Weaver, Inc.	6 wells (Ln-1513, 1514, 1515, 1516, 1517, 1518)
	Wilbur Chocolate Company, Inc.	3 wells (Ln-1510, 1511, 1512)
Lebanon	Aluminum Company of America	4 wells (Lb-1087, 1088, 1089, 1090)
	Bethlehem Steel Corporation	2 wells (Lb-1111, 1112)
	C. F. Manbeck, Inc.	1 well (Lb-1113)
	Grimes Poultry Processing Corporation	2 wells (Lb-1101)
	Michters Distillery, Inc.	3 wells (Lb-713, 724, 725)
	Quaker Alloy Casting Company	1 well (Lb-783)
	Sterling Drug, Inc.	1 well (Lb-704)
Schuylkill	Penn Dye and Finishing Company, Inc.	2 wells (Sc-524, 525)
York	Litton Business Systems, Inc., Cole Division	1 well
	J. E. Baker Company	1 well (Yo-725)
	Medusa Portland Cement Company	2 wells (Yo-726, 727)

[1] Well numbers refer to those used on Plate 1 and Table 20.

Table 6. *Mineral Extraction and Processing Sites Withdrawing More than 100,000 Gallons of Groundwater per Day*

County	Name	Withdrawal (gal/d)	Sources(s)
Adams	Bethlehem Steel Corp. Hanover quarry	11,732,000	Mine water
Dauphin	Pennsy Supply, Inc. Hummelstown quarry	288,000	Mine water
	Hempt Bros. Steelton quarry	120,500	Mine water
Lebanon	Bethlehem Steel Corp. Millard quarry	3,452,000	Mine water
	Calcite Quarry Corp.[1]	9,357,000	Mine water
Northumberland	Gilberton Coal Co. Locust Summit Fine Coal Plant	350,000	Mine water
York	J. E. Baker Co.	1,429,000	Wells, mine water
	Thomasville Stone and Lime Co. Thomasville operation	2,879,000	Mine water

[1] Quarry is located topographically in the Delaware River basin; however, a portion of the pumpage is obtained from the Susquehanna River basin.

A substantial amount of water enters the Lower Susquehanna River basin by way of the main stem of the Susquehanna River. Precipitation is the source of essentially all of the rest of the water that enters the basin. Water leaves the basin either as water vapor to the atmosphere (evapotranspiration), surface runoff, or groundwater discharge to streams. The average amounts shown on the diagram are approximations for illustrative purposes only and are not intended for use in detailed planning. Thorough discussion of the amount and variation of the components in the cycle is given in the sections that follow.

WATER BUDGETS

A water budget is a quantitative expression of the major components of the hydrologic cycle. Water that enters a basin as precipitation is balanced against water that leaves a basin as evapotranspiration and streamflow. This balance can be expressed in a simplified equation as follows.

$$P = R_s + R_g + ET \pm \Delta S$$

where

P = precipitation
R_g = groundwater discharge to streams
R_s = surface or direct runoff
ET = water lost by evaporation and transpiration
ΔS = change in amount of water in storage
($R_g + R_s$ = total streamflow)

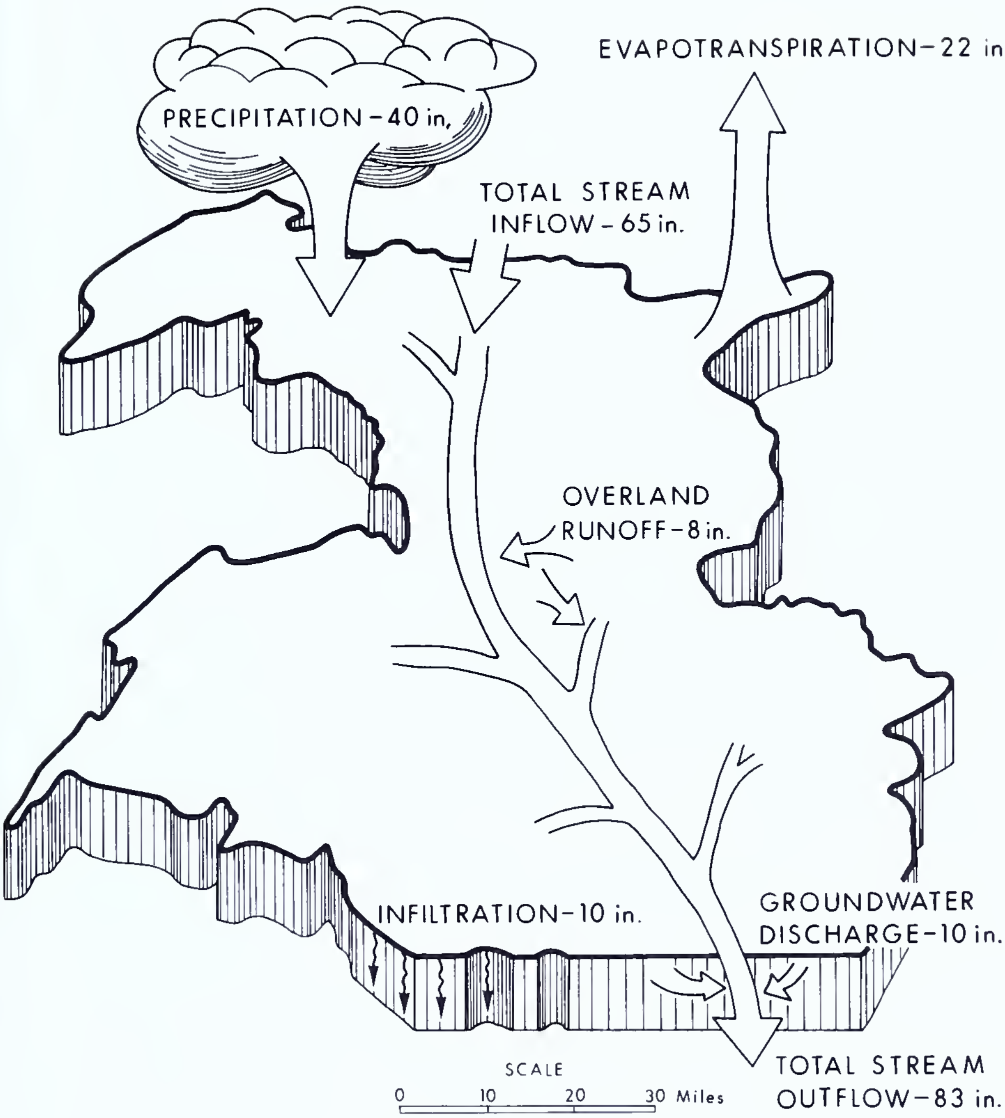

Figure 5. The annual hydrologic cycle for the Lower Susquehanna River basin.

Water-budget analyses have been published for several subbasins within the Lower Susquehanna River basin (Figure 6). Two additional subbasins were selected for analysis in this study: East Mahantango Creek basin because it drains mixed lithologies in the Valley and Ridge physiographic province, and West Conewago Creek basin because it primarily drains shales and sandstones in the Triassic Lowland section of the Piedmont physiographic province.

The results of the water-budget analyses are presented in Table 7. The time period selected for analysis (1961–80) was utilized because it incorporates one of the driest periods of record (the early 60's) and one of the wettest periods of record (the 70's). Thus, the table gives nearly the full range of expected water-budget values.

Figure 6. Location of drainage basins used for water-budget analysis in this report, and location of other basins for which there is published water-budget information.

The subsequent sections contain fairly detailed descriptions of each major hydrologic component listed in Table 7, and are followed by a section that relates the baseflow information obtained in this study and other published studies to the areal availability of groundwater.

PRECIPITATION (P)

Precipitation normals for 14 weather stations were used to prepare a contour map showing the distribution of average annual precipitation (Figure 7). A linear trough in the contours which roughly follows the main valley of the Susquehanna River dominates the map. Precipitation values steadily increase away from the river to the east, reaching a high of over 45 inches in Schuylkill County. Other precipitation highs occur on South Mountain and in southern York County. The weighted average for the complete area is about 40 inches.

The contour map of average precipitation is useful for showing the typical patterns of precipitation highs and lows that occur in the basin. However, yearly precipitation at a single location often varies considerably from

Table 7. *Water Budgets for Major Stream Basins*

Water year	Precipitation P (inches)	=	Surface runoff R_s (inches)	+	Groundwater discharge R_g (inches)	+	Evapotranspiration ET (inches)
			East Mahantango Creek Basin (gaging station near Dalmatia)				
1961	37.04	=	4.86	+	12.18	+	20.00
1962	42.71	=	3.93	+	8.05	+	30.73
1963	36.24	=	2.95	+	10.49	+	22.80
1964	35.80	=	6.68	+	11.11	+	18.01
1965	30.17	=	1.87	+	5.57	+	22.73
1966	32.82	=	3.27	+	7.75	+	21.80
1967	38.50	=	4.18	+	11.89	+	22.42
1968	40.01	=	5.31	+	11.24	+	23.46
1969	37.46	=	3.29	+	8.66	+	25.51
1970	39.54	=	7.55	+	12.67	+	19.32
1971	40.67	=	6.04	+	12.94	+	21.69
1972	55.81	=	20.57	+	17.56	+	17.68
1973	48.52	=	6.53	+	14.49	+	27.50
1974	49.52	=	6.67	+	14.73	+	28.12
1975	52.11	=	13.45	+	16.06	+	22.60
1976	40.83	=	4.42	+	13.16	+	23.25
1977	48.64	=	10.70	+	13.79	+	24.15
1978	54.64	=	11.10	+	19.19	+	24.35
1979	48.61	=	10.66	+	15.74	+	22.21
1980	35.93	=	5.70	+	13.80	+	16.43
Long-term average (1961–80)	42.28	=	6.99	+	12.55	+	22.74

Table 7. *(Continued)*

Water year	Precipitation P (inches)	=	Surface runoff R_s (inches)	+	Groundwater discharge R_g (inches)	+	Evapotranspiration ET (inches)
			West Conewago Creek Basin (gaging station near Manchester)				
1961	41.87	=	8.27	+	8.57	+	25.03
1962	34.37	=	8.05	+	6.46	+	19.86
1963	35.28	=	6.11	+	6.73	+	22.44
1964	40.58	=	8.06	+	6.58	+	25.94
1965	30.10	=	3.99	+	4.34	+	24.77
1966	30.78	=	3.97	+	3.62	+	23.19
1967	39.89	=	6.00	+	7.32	+	26.57
1968	39.44	=	6.75	+	6.80	+	25.89
1969	32.76	=	5.28	+	5.19	+	22.29
1970	39.97	=	10.84	+	10.28	+	18.85
1971	45.53	=	7.88	+	10.45	+	27.20
1972	53.76	=	16.95	+	12.88	+	23.93
1973	45.54	=	10.07	+	11.19	+	24.28
1974	39.21	=	7.59	+	8.62	+	23.00
1975	51.65	=	16.57	+	11.05	+	24.03
1976	37.29	=	7.19	+	9.52	+	20.58
1977	31.40	=	7.59	+	6.90	+	16.91
1978	42.24	=	11.46	+	12.16	+	18.62
1979	46.35	=	10.83	+	10.23	+	25.29
1980	36.45	=	6.17	+	9.59	+	20.69
Long-term average (1961–80)	39.87	=	8.48	+	8.42	+	22.97

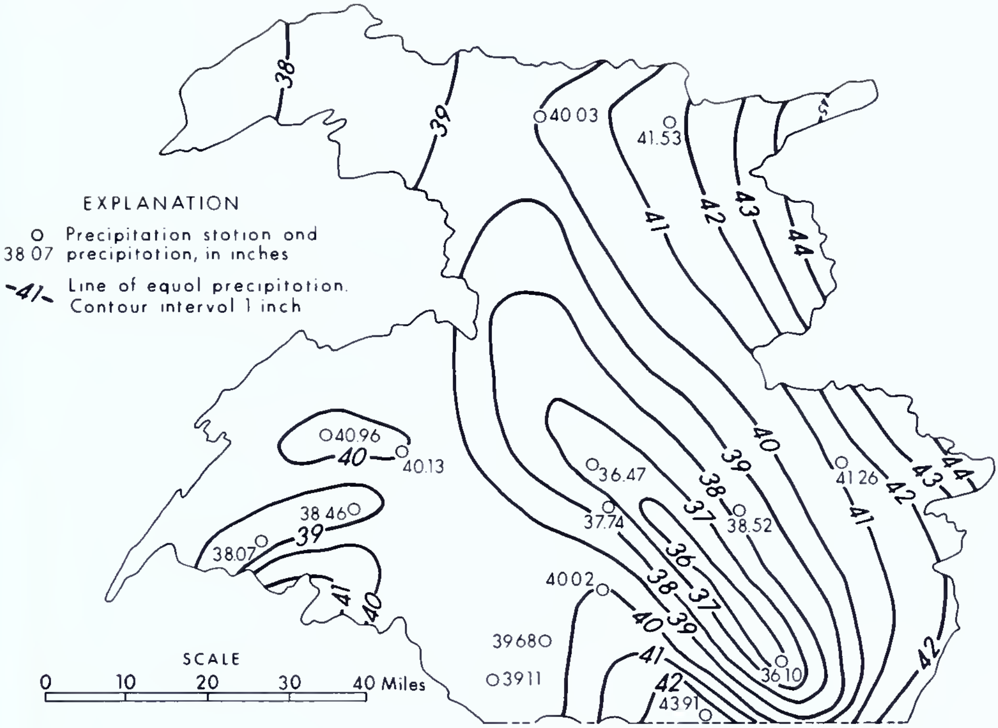

Figure 7. Average annual precipitation in the Lower Susquehanna River basin.

the average. Based on an analysis of long-term records for weather stations at Shamokin (51 years) and Spring Grove (47 years), annual precipitation is within 1 inch of the mean about 8 percent of the time and deviates more than 5 inches from the mean 45 percent of the time. The average range (difference between the maximum and minimum precipitation) for the two stations is 26 inches. Because of this variation caution must be exercised in using average amounts of precipitation for water-resource planning.

One technique for estimating the reliability (or variability) of precipitation is the use of frequency curves. Figure 8 shows frequency plots of annual precipitation at Shamokin and Spring Grove, the stations used in the water-budget analyses for East Mahantango Creek basin and West Conewago Creek basin, respectively.

Frequency plots can be used to estimate the recurrence interval (or probability of occurrence) for an annual precipitation amount of a particular magnitude (the recurrence interval is the inverse of the frequency expressed as a percent, multiplied by 100). Note that there is considerable difference in the 50 percent (2-year recurrence interval) precipitation values—43.0 inches at Shamokin versus 39.4 inches at Spring Grove. However, the 10 percent values are very close (about 33 inches). This suggests that, although more water is available in the Shamokin area during normal times, during dry periods the total water available at the two locations is about the same.

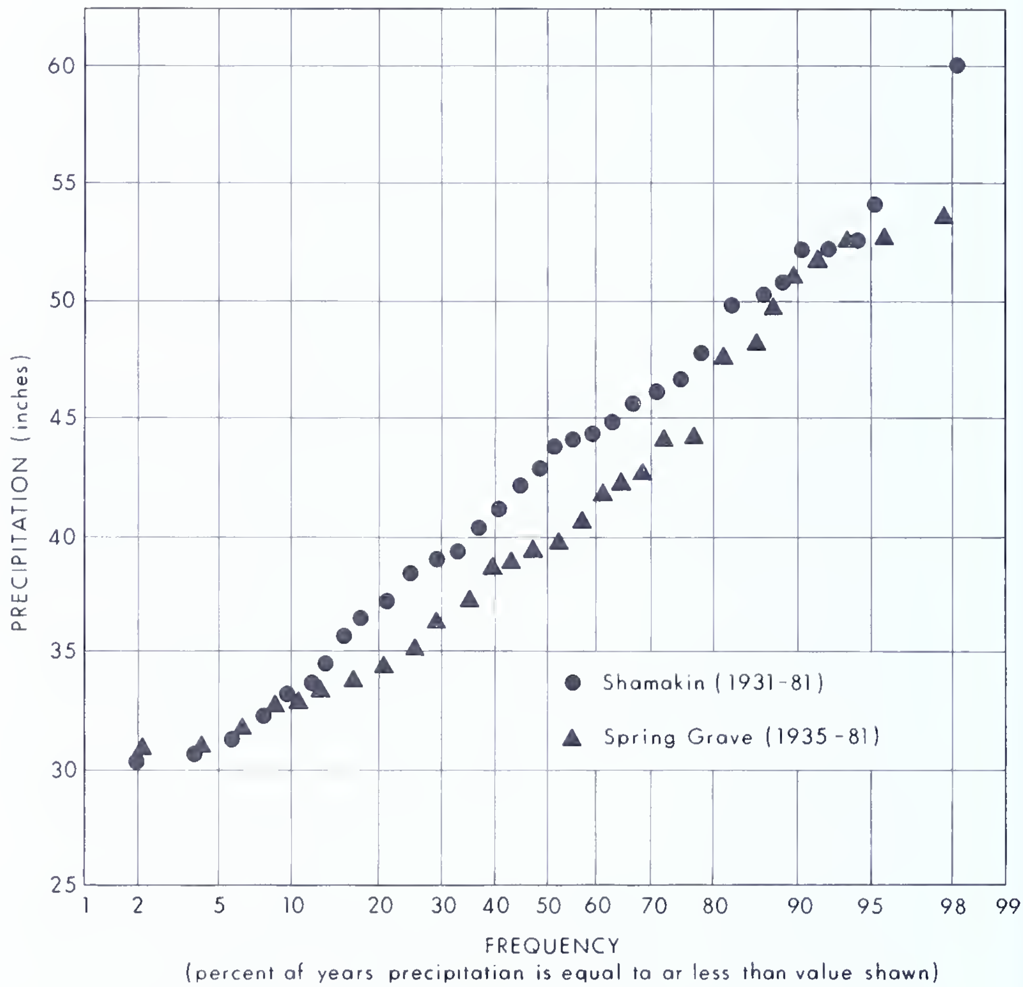

Figure 8. Percent frequency distribution of annual precipitation at Shamokin and Spring Grove. For clarity, not all years are shown.

STREAMFLOW ($R_g + R_s$)

Streamflow records were obtained from the U.S. Geological Survey for the two gaging stations listed in Table 7. The groundwater (R_g) and surface-flow (R_s) components were separated from the total streamflow on hydrographs using conventional methods.

Annual groundwater flow to streams (baseflow) makes up about 65 percent of streamflow in the East Mahantango Creek basin. This percentage (between 60 and 65 percent) is typical for basins underlain by sandstone and shale of the Appalachian Mountain section of the Valley and Ridge physiographic province. Similar values were obtained for a comparable geologic setting in the Juniata River basin (Taylor and others, 1982).

On the average, only about half of the streamflow in the West Conewago Creek is provided by groundwater. This is among the lowest percentages obtained in Pennsylvania and is probably due to the fact that recharge is limited by the relatively low permeability of soils developed on Triassic-age sedimentary rocks. Also, these rocks have a low storage capacity for groundwater and thus cannot sustain large baseflows.

The relationship between streamflow and baseflow has been evaluated for several small basins within the Lower Susquehanna River basin. The results of these evaluations are summarized in Table 8. Many of these analyses are for a short period of record, which limits their utility. However, in most instances the authors attempted to select typical years in order to reflect long-term average conditions.

As shown in the table, there is a wide range in the percentage of streamflow contributed by groundwater, which is largely a result of variations in the underlying geology. The highest baseflows are sustained in the basins underlain primarily by carbonate rock: Quittapahilla Creek, Yellow Breeches Creek, and Little Conestoga Creek. Intermediate flows occur in the Conodoguinet Creek basin, which is underlain by carbonate rock but also contains a significant amount of shale bedrock, and the Muddy Creek basin, which is underlain by metamorphic rocks of the Piedmont physiographic province. The noncarbonate sedimentary rocks of the Valley and Ridge physiographic province sustain baseflows in the intermediate range (East Mahantango Creek basin). The lowest baseflows are sustained in the West Conewago Creek basin, as described previously.

The low value in the table (49 percent) for the Swatara Creek basin is probably a result of two factors: first, there is a large percentage of comparatively low permeability shale and sandstone in the basin, and, second, the baseflow separation technique used by the authors is different from that used in the other studies and may have produced a low estimate for baseflow.

Figures 9 and 10 are frequency plots of annual runoff for the two basins analyzed in this project. Also shown are baseflow frequency plots which were prepared by correlating the data in Table 7 and the total-runoff plots. Two important observations can be made from the plots. The slope of the lines gives an indication of the consistency of the resource; the steeper the slope, the more variable the flow. Although the total-runoff plots in Figures 9 and 10 have about the same slope, the base-runoff plot for West Conewago Creek is not as steep as that for East Mahantango Creek. This suggests that the groundwater resource is somewhat more reliable in the West Conewago Creek basin. However, the second observation that can be made concerns the vertical position of the lines. From this it is apparent that the baseflows are more consistent in the West Conewago Creek basin, but at a significantly lower level of flow (the median baseflow is about 30 percent lower).

Table 8. *Summary of Streamflow and Groundwater Contributions to Streamflow for the Lower Susquehanna River Basin*

Basin and location of gage	Period of record	Average streamflow (inches)	Average groundwater flow (inches)	Proportion of total flow made up of groundwater flow (percent)
Little Conestoga Creek at Conestoga Country Club[1]	Jan. 1964–Dec. 1964	15.3	11.6	76
Muddy Creek near Castle Fin[2]	Jan. 1969–Dec. 1970	14.4	10.0	69
Yellow Breeches Creek near Camp Hill[3]	1968–74	21.0	16.8	80
Conodoguinet Creek near Hogestown[3]	1968–74	19.9	13.3	67
Swatara Creek above Harper Tavern[4]	42-year composite record	23.2	11.3	49
Quittapahilla Creek west of Annville[5]	Oct. 1960–Sept. 1961	17.3	15.1	87
West Conewago Creek near Manchester	1961–80	16.9	8.4	50
East Mahantango Creek near Dalmatia	1961–80	19.5	12.6	65

[1] From Meisler and Becher (1971).
[2] From Lloyd and Growitz (1977).
[3] From Becher and Root (1981).
[4] From Stuart and others (1967).
[5] From Meisler (1963).

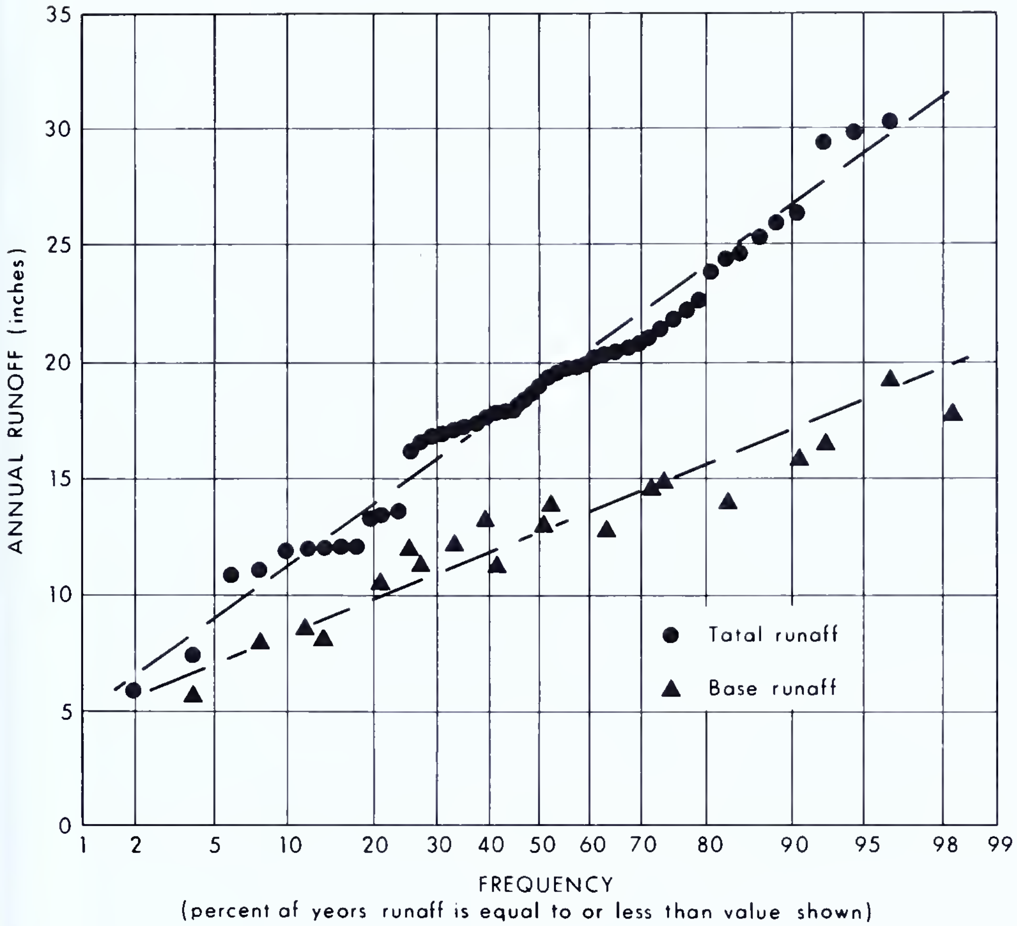

Figure 9. Percent frequency distribution of annual runoff from East Mahantango Creek near Dalmatia (1930–80).

EVAPOTRANSPIRATION (ET)

Evaporation from water bodies, wetted surfaces, and moist soil by direct evaporation, and vapor that escapes from living plants by the process of transpiration are collectively called evapotranspiration (ET). The amount of ET varies with the length of the growing season, the average temperature, and the amount and timing of precipitation and humidity. Consumptive losses to ET are at a minimum between the first killing frost in the fall and the active resumption of plant growth in the spring. Most of the recharge to the groundwater system occurs during this time period, as shown on the water-level curve in Figure 11.

The amount of water lost to ET is estimated by evaluating the difference between precipitation and streamflow. Any annual changes in groundwater storage (ΔS) are also included in this computed difference. However, in-

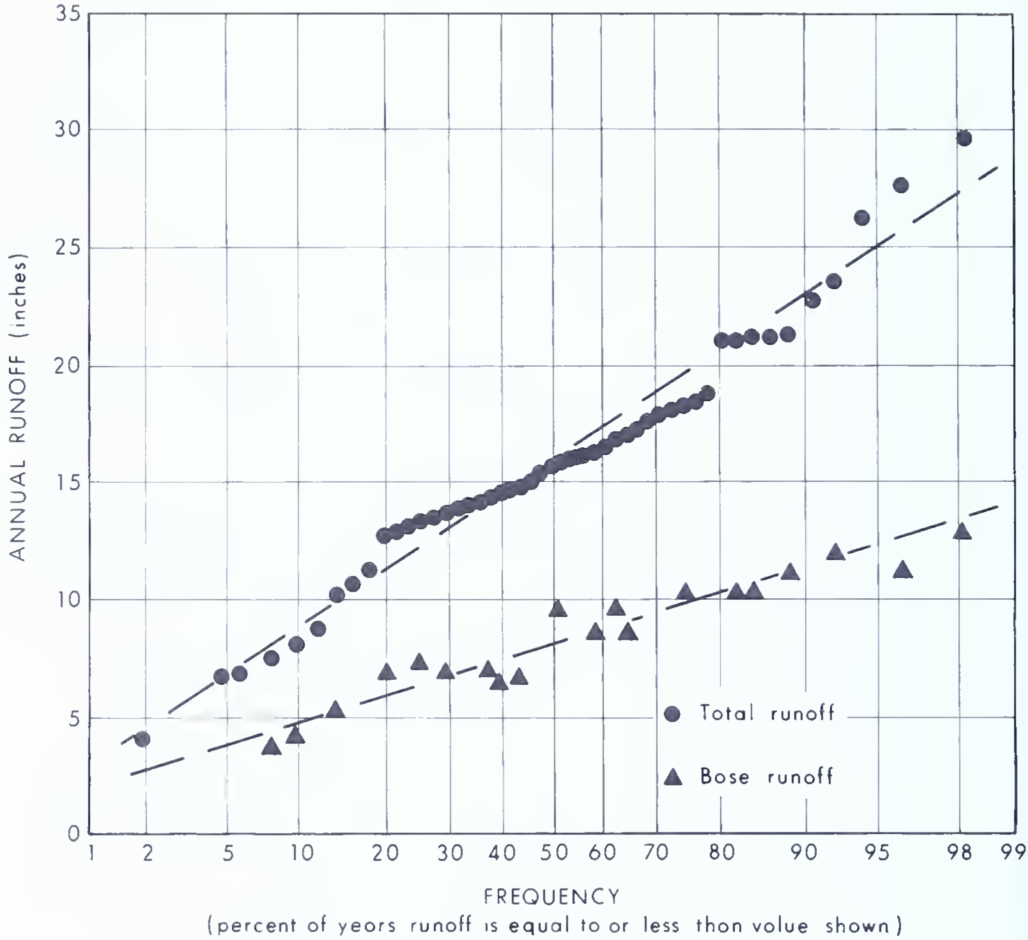

Figure 10. Percent frequency distribution of annual runoff from West Conewago Creek near Manchester (1931–80).

creases or decreases in storage essentially balance one another if a long enough period of record is used.

Table 9 is a summary of reported and calculated ET values for the Lower Susquehanna River basin. An estimated 48 to 63 percent of precipitation is lost to evapotranspiration. The values, in general, vary directly with average temperature within the basins; the percentages decrease from south to north. The anomalously low value for the Yellow Breeches Creek basin is due to the fact that it has a 100 foot higher average elevation than the adjacent Conodoguinet Creek basin (Becher and Root, 1981, p. 10).

ESTIMATE OF AREAL AVAILABILITY OF GROUNDWATER

Baseflow data can be used to calculate the average groundwater discharge per unit of land surface. If there are no significant changes in groundwater storage and if evapotranspiration directly from groundwater is assumed to be negligible, then this discharge per unit of land surface provides an esti-

Table 9. *Summary of Evapotranspiration (Water Loss) Estimates for the Lower Susquehanna River Basin*

Basin	Period of record	Precipitation (inches)	Evapotranspiration (inches)	Proportion of precipitation lost to evapotranspiration (percent)
Muddy Creek[1]	1931–39	43.00	27.07	63
Yellow Breeches Creek[2]	1968–74	43.22	20.54	48
Conodoguinet Creek[2]	1968–74	42.23	23.13	55
Swatara Creek[3]	42-year composite record	46.38	23.17	50
West Conewago Creek	1961–80	39.87	22.97	58
East Mahantango Creek	1961–80	42.28	22.74	54

[1] From Lloyd and Growitz (1971).
[2] From Becher and Root (1981).
[3] From Stuart and others (1967).

mate of groundwater recharge. The amount of recharge to the groundwater system is the practical upper limit of development (consumptive withdrawals) for an aquifer or basin. Withdrawals in excess of recharge can cause a progressive lowering of water levels and severely reduce the flow of streams.

The baseflow analyses performed in this report provide estimates of recharge to the diverse rock types in the Valley and Ridge physiographic province (Mahantango Creek) and the rocks of Triassic age (West Conewago Creek). Estimated average recharge to the diverse rock types in the Valley and Ridge physiographic province ranges between 184 and 635 (gal/min)/mi^2 (gallons per minute per square mile), and the mean is 414 (gal/min)/mi^2.

Estimated recharge to the rocks of Triassic age ranges from 120 to 426 (gal/min)/mi^2, and the mean is 278 (gal/min)/mi^2. These estimates are among the lowest for any rock types in Pennsylvania and suggest that recharge over a fairly large area must be captured in order to sustain large withdrawals from the Triassic rocks.

Estimates of average annual recharge for the portion of the basin south of Blue Mountain have been made by Gerhart and Lazorchick (in preparation). These estimates are based on the results of digital modeling and some baseflow analyses and are listed in Table 10. The values given in the table can be converted to gallons per minute per square mile by multiplying by 694. Note that the converted values for the rocks of the Triassic Lowland,

Table 10. ***Estimate of Average Annual Groundwater Recharge by Hydrogeologic Unit***[1]

(Modified from Gerhart and Lazorchick, in preparation)

Hydrogeologic unit	Average annual groundwater recharge ((Mgal/d)/mi^2)
Shale in the western Great Valley and shale containing significant graywacke in the eastern Great Valley	0.53
Shale of the eastern Great Valley not containing significant graywacke	.44
Carbonate rocks in the eastern Great Valley	.75
Carbonate rocks in the western Great Valley	.64
Sedimentary rocks of the western Triassic Lowland section	.34
Sedimentary rocks of the eastern Triassic Lowland section	.51
Carbonate rocks of the western Conestoga Valley section	.51
Carbonate rocks of the eastern Conestoga Valley section	.70
Shale of the northern Conestoga Valley section	.53
Metamorphic rocks of the Conestoga Valley section (west of the Susquehanna River)	.31
Metamorphic rocks of the Piedmont Uplands section	.47

[1] The combination of dominant lithology and physiographic location was used to define hydrogeologic units.

236 (gal/min)/mi^2 in the western part and 354 (gal/min)/mi^2 in the eastern part, are in reasonable agreement with the 278 (gal/min)/mi^2 obtained in this study.

HYDROGEOLOGY

GEOLOGIC SETTING

The geology of the Lower Susquehanna River basin is characterized by a large diversity of rock types and structural settings. As a result, the area has been separated into the six physiographic provinces or sections shown in Figure 3.

The Appalachian Mountain section consists of broadly folded, Paleozoic sedimentary rocks that range in age from Ordovician to Pennsylvanian. The rock sequence is grossly divisible into a lower carbonate (nonclastic) interval overlain by two clastic intervals (sandstone and shale) which are separated by a thinner nonclastic carbonate and shale group. The lower nonclastic interval includes the Bellefonte and Axemann Formations, undivided, and the Coburn Formation through the Loysburg Formation, undivided. The lowest clastic interval includes all of the rocks from the Upper Ordovician Bald Eagle Formation through the Middle Silurian Bloomsburg Formation. This is overlain by a thinner, predominantly carbonate interval consisting of the Wills Creek, Tonoloway, Keyser, Old Port, and Onondaga Formations. The strata above the Onondaga are entirely clastic, and include the interval from the Hamilton Group to the Llewellyn Formation.

The northern portion of the Great Valley section is underlain by the Martinsburg Formation and rocks of the Hamburg sequence, which consist of folded and faulted shale, limestone, and some graywacke. The remainder of the section is underlain primarily by tightly folded and faulted carbonate rocks of Cambrian and Ordovician age. The rocks of the Great Valley do not constitute a single stratigraphic sequence because faulting has brought together rocks that were originally deposited in widely separated parts of the Appalachian basin. Thus two sets of stratigraphic names are used to describe the rocks of the Great Valley in later sections of this report.

The Blue Ridge province contains some of the oldest rocks in the basin. They consist of Precambrian volcanic rocks which are overlain by metamorphosed sedimentary rocks (the Antietam Formation through the Loudoun Formation). The geologic structure throughout the province is extremely complex.

The Triassic Lowlands section is underlain by relatively nonresistant red shale, sandstone, conglomerate, and minor amounts of limestone. Structurally, the rock layers form a monocline having a predominantly northwesterly dip of about 15 to 35 degrees. In many areas the lowland is criss-

crossed by ridges and hills formed by diabase dikes and sheets that were intruded into the sedimentary rocks.

The Conestoga Valley section is underlain chiefly by Cambrian- and Ordovician-age carbonate rocks and shale. These rocks have been subjected to severe and recurring stress throughout much of geologic history and as a result are highly folded and faulted.

The Piedmont Uplands section is primarily composed of metamorphosed sedimentary rocks but also contains some igneous rocks. The geologic structure in this section is extremely complex.

OCCURRENCE AND MOVEMENT OF GROUNDWATER

The portion of precipitation that does not run off or is not lost by evapotranspiration infiltrates the soil and moves downward through the soil and rock until it reaches the water table, below which all of the interconnected voids are filled with water. After reaching this saturated zone, the water moves slowly downward and laterally toward lower altitudes (or lower hydraulic potential) and eventually returns to the land surface, either from springs or by channel seepage to provide the baseflow to streams.

The water table fluctuates according to the relative amounts and rates of recharge to and discharge from the groundwater system. Figure 11 shows the mean monthly temperature, precipitation, and representative groundwater levels for eastern Snyder County. Precipitation ranges from more than 4 inches in May to about 2-1/2 inches in February. However, the water level in well Sn-130 shows only a marginal relationship to precipitation, whereas the level appears to be inversely related to temperature. This demonstrates the effect of evapotranspiration on recharge. Most groundwater recharge occurs after the spring thaw and prior to the onset of vigorous plant growth in April and May, and after the first killing frost in October and before the ground freezes in December. During the summer there is normally a steady decline in water levels because large evapotranspiration losses allow only a small amount of recharge to reach the saturated zone. Thus the seasonal variation in precipitation is often more critical to the groundwater resource than the annual total. A dry spring or fall may have considerable effect as opposed to a dry summer, which might have much less effect on the resource; however, some recharge is essential throughout the year.

A hydrograph of well Sn-130 (the Snyder County observation well) for the period 1975-80 is included to show typical fluctuations in the annual pattern of water levels (Figure 12). Note the steady decline in water level from May to September 1980; this represents the early stages of the 1980-81 drought. Although the July 1980 level in this well was in the normal range, the almost total lack of recharge in August and especially September triggered the onset of this relatively short term but costly drought. A record

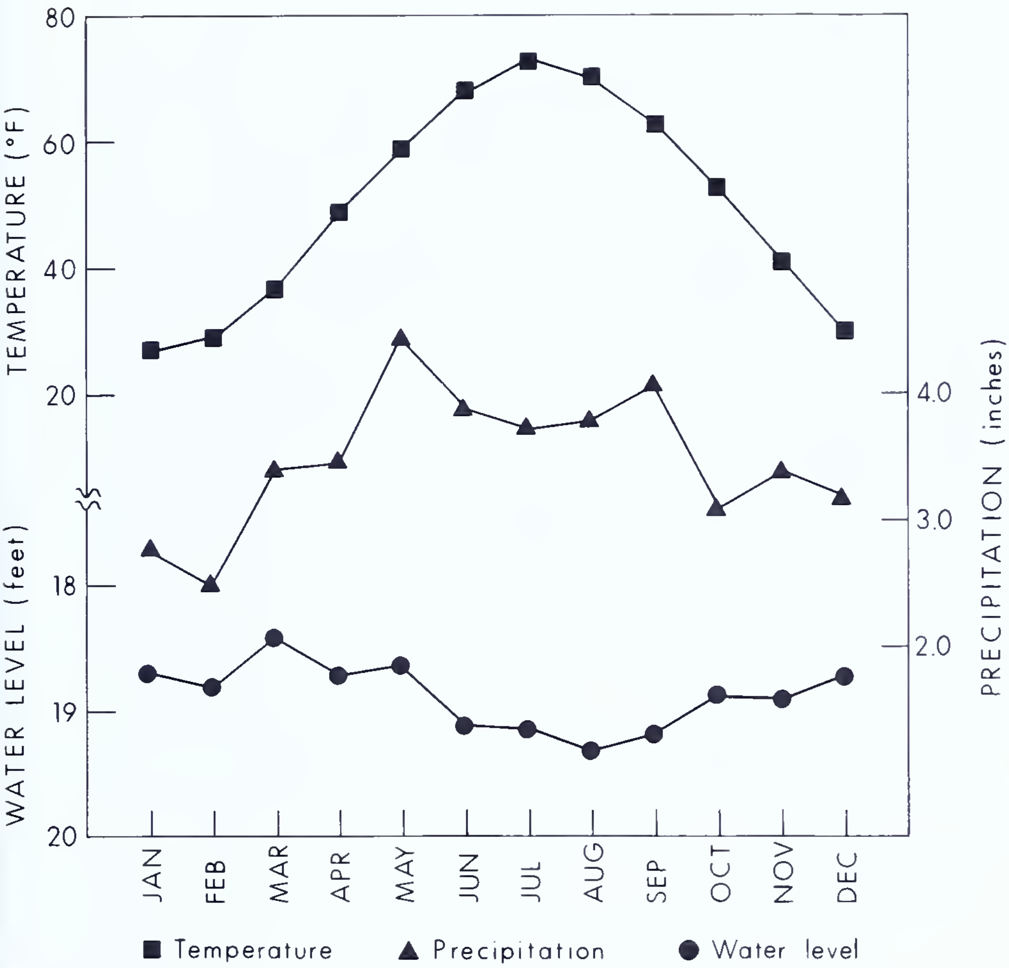

Figure 11. Mean temperature and precipitation at Selinsgrove and mean water level in well Sn–130 (1975–80).

minimum water level in this well of 19.57 feet was reached on November 23, 1980 (period of record is June 1968 to the present). Heavy rains and an early thaw in February eased the problem; however, comparatively low water levels continued throughout the year.

The water table in the basin is subparallel to the land surface; water levels under hills are at higher altitudes than those in valleys. The depth to water varies with rock type, physiography, and precipitation. Water levels measured in domestic wells in the Appalachian Mountain section of the Valley and Ridge physiographic province have a median depth of 19 feet in valleys (170 wells), 35 feet under hillsides (342 wells), and 49 feet under hilltops (21 wells). Typical water levels for different rock types in various physiographic settings for the part of the basin south of Blue Mountain are given by Gerhart and Lazorchick (in preparation) and are listed in Table 11.

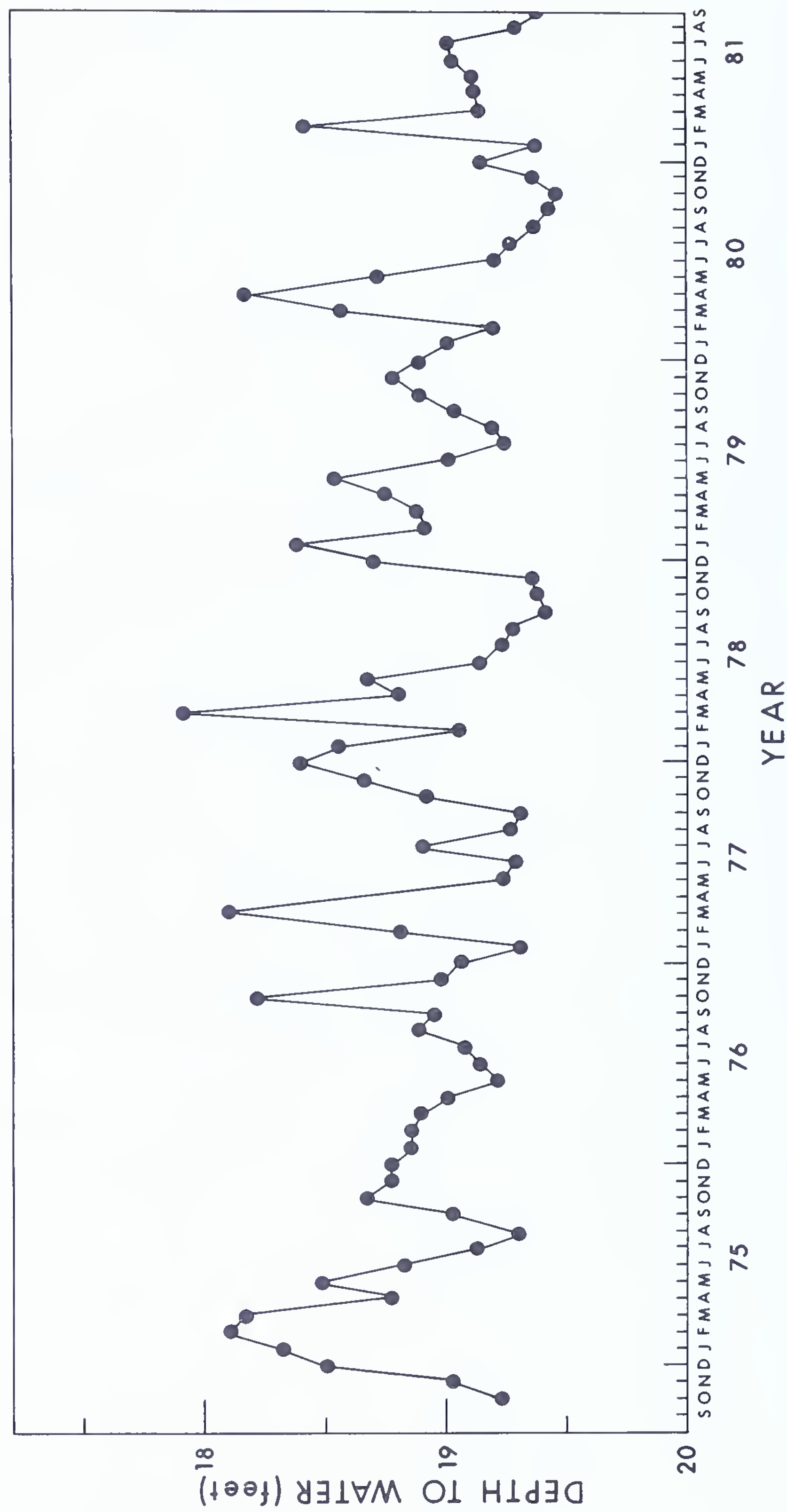

Figure 12. Mean monthly depth to water in well Sn–130.

Table 11. *Depth to Water in Different Topographic Settings, by Hydrogeologic Unit*
(Modified from Gerhart and Lazorchick, in preparation)

Hydrogeologic unit	Depth to water, in feet below land surface		
	Hilltop	Hillside[a]	Valley
Shale in the western Great Valley and shale containing significant graywacke in the eastern Great Valley	34	23	12
Shale of the eastern Great Valley not containing significant graywacke	29	23	21
Carbonate rocks in the eastern Great Valley	63[b]	34[b]	15[b]
Carbonate rocks in the western Great Valley	83	46	18
Sedimentary rocks of the western Triassic Lowland section	40	24	17
Sedimentary rocks of the eastern Triassic Lowland section	40	24	11
Carbonate rocks of the western Conestoga Valley section	43	28	13
Carbonate rocks of the eastern Conestoga Valley section	47[b]	32[b]	16[b]
Shale of the northern Conestoga Valley section	45	34	10
Metamorphic rocks of the Conestoga Valley section (west of the Susquehanna River)	40	30	9
Metamorphic rocks of the Piedmont Uplands section	37	28	9

[a] The middle slope category of Gerhart and Lazorchick.

[b] Average values for two of Gerhart and Lazorchick's hydrogeologic units which have been combined in this table.

FACTORS THAT INFLUENCE THE YIELD OF WELLS

The yield of a well depends largely on the size, number, distribution, and degree of interconnection of the water-filled openings penetrated by the well. These openings or water-bearing zones may be fractures, bedding-plane partings, or small voids between the grains that make up the rock.

Table 12 is a summary of available data on water-bearing zones for the northern part of the basin. Water-bearing-zone data for the southern part of the basin are available in several published reports (Figure 2). In Table 12, the numerator of the fraction indicates the number of reported water-bearing zones, and the denominator indicates the number of wells penetrating a particular depth range. In the shallowest depth range, the denominator indicates the total number of wells in that formation for which data on depth to water-bearing zones were obtained. Thus, data were obtained for 118 wells in the Catskill Formation. The value (or magnitude) of the fraction indicates the relative abundance of water-bearing zones with depth. In the Catskill Formation, water-bearing zones were most abundant in the 101- to 150-foot interval; about 89 percent of the wells in this interval penetrated a water-bearing zone. Also listed is the deepest reported water-bearing zone for each rock unit. If there are a sufficient number of deep wells this value should give an indication of the depth of groundwater circulation within the particular rock unit.

The ratio given in the table for the shallowest interval (0 to 50 feet) is somewhat misleading because the casing length and static water level were not taken into account. However, the data probably indicate the abundance of zones that provide water to wells in that interval.

Geologic factors that control the type and distribution of water-bearing zones, and thus well yields, are described in the following three sections.

Lithology

Rock type is the most important factor in determining well yield. The occurrence of both primary and secondary porosity and permeability is substantially controlled by lithology.

Lithological factors that control development of secondary openings are rock susceptibility to solution, rock susceptibility to fracturing, and size and spacing of bedding-plane partings.

Enlargement of primary and secondary openings by solution occurs mainly in the carbonate rocks, limestone and dolomite. Occasionally the permeability of sandstone units has been increased by the solution removal of calcite cement from the particles that make up the rock. The Ridgeley Member of the Old Port Formation has been known to exhibit this type of solution.

The size and spacing of fractures are a result of the response of the rock mass to the stresses placed upon it. Certain rock types, such as sandstone

Table 12. *Summary of Data on Water-Bearing Zones*

Group, formation, or member[1]	Ratio of number of water-bearing zones of specified depth range (numerator) to number of wells penetrating this range (denominator) — Depth range (feet): 0-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	451-500	>500	Deepest zone
Llewellyn Formation	7/15	16/15	7/7	2/4	1/3	1/3	0/2	1/1	—	—	—	362
Pottsville Group	0/1	3/1	0/1	—	—	—	—	—	—	—	—	99
Mauch Chunk Formation	14/97	80/97	58/72	18/36	7/17	5/6	0/8	1/5	2/5	0/5	1/1	552
Pocono Formation	0/3	2/3	2/3	2/3	2/2	0/1	0/1	0/1	0/1	1/1	0/1	477
Catskill Formation, undivided[2]	9/118	67/109	85/95	40/62	16/43	13/26	5/11	2/8	2/4	0/3	2/2	514
Sherman Creek Member of Catskill Formation	2/51	23/42	31/39	23/27	6/19	7/12	1/5	0/3	2/2	0/1	1/1	514
Irish Valley Member of Catskill Formation	6/35	32/35	28/27	8/14	5/8	1/4	0/1	0/1	—	—	—	300
Brallier and Harrell Formations, undivided	0/10	5/10	3/8	7/7	3/5	1/3	1/3	0/1	—	—	—	328
Trimmers Rock Formation	8/51	20/51	24/38	23/27	8/12	2/8	3/5	1/2	0/1	1/1	—	460
Hamilton Group	24/91	81/86	43/62	24/33	11/21	6/12	1/4	3/3	—	—	—	396

Table 12. *(Continued)*

Group formation, or member [1]	Ratio of number of water-bearing zones of specified depth range (numerator) to number of wells penetrating this range (denominator) — Depth range (feet): 0-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400	401-450	451-500	>500	Deepest zone
Onondaga and Old Port Formations, undivided	4/16	14/14	10/11	3/5	0/3	1/3	1/3	1/2	0/2	1/1	—	460
Keyser and Tonoloway Formations, undivided	17/23	19/17	12/17	14/17	5/6	1/3	0/1	0/1	0/1	1/1	—	470
Wills Creek Formation	32/74	76/74	42/33	9/12	8/6	3/5	0/1	0/1	0/1	—	—	261
Bloomsburg and Mifflintown Formations, undivided	12/41	34/41	11/25	7/16	4/12	2/8	0/5	3/5	1/3	1/2	3/2	606
Clinton Group	5/16	13/15	9/11	1/6	2/6	2/4	0/3	2/2	—	—	—	363
Tuscarora Formation	0/1	2/1	—	—	—	—	—	—	—	—	—	70
Juniata Formation	0/4	0/4	1/4	1/3	1/2	0/1	0/1	0/1	1/1	0/1	0/1	412
Reedsville Formation	9/23	16/21	8/9	5/9	2/7	0/3	1/1	—	—	—	—	345
Coburn Formation through Loysburg Formation, undivided	8/28	14/28	12/20	13/17	10/12	3/10	3/5	0/1	0/1	0/1	—	347

[1] Only those units for which data were obtained are listed.

and dolomite, are more likely to undergo brittle fracture when stressed and thus have a greater abundance of fractures. Thin-bedded units within the same rock type generally have a closer fracture spacing.

Figure 13 shows the percent frequency distribution of nondomestic well yields from the Appalachian Mountain physiographic section that have been grouped according to dominant rock type. The importance of lithology is apparent. The yields from wells developed in shale are consistently

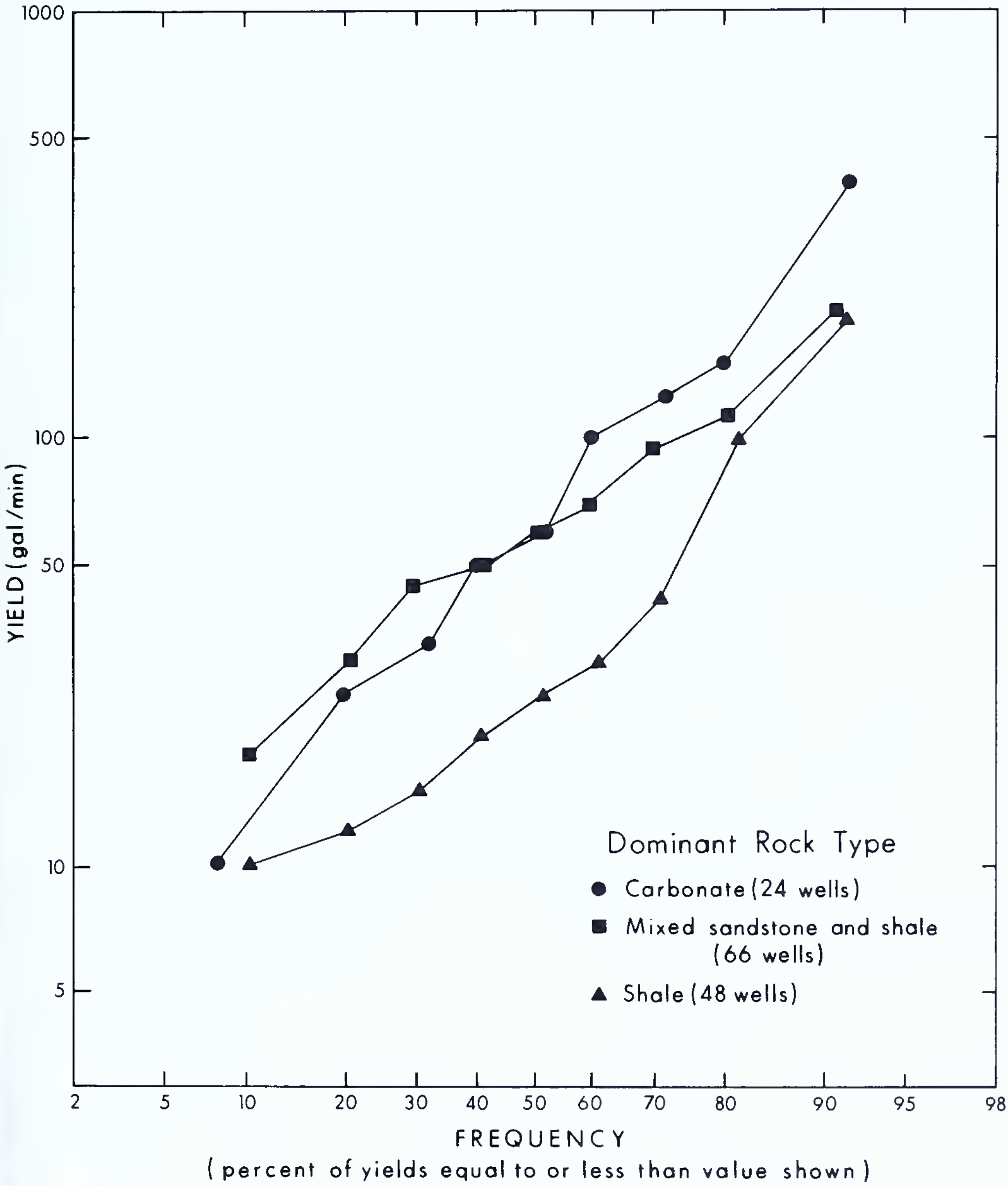

Figure 13. Percent frequency distribution of nondomestic well yields from the Appalachian Mountain section, grouped according to dominant rock type.

lower than those from other types, and the highest yields are from the carbonate rock types. However, the yields from the mixed sandstone and shale rock units are somewhat less variable than the others, as indicated by the slope of the graph, which is not quite as steep as the slopes of the others.

Topography

Several recent studies have evaluated the relationship of topography to well yield (Taylor and others, 1982; Meisler and Becher, 1971; Becher and Root, 1981; and others). All have shown a significant relationship between the topographic position of a well and well yield. Wells in higher topographic positions (hilltops and hillsides) have smaller yields than those in lower topographic positions (valleys, gullies, and draws).

Valleys and draws often form where the bedrock is most susceptible to physical or chemical weathering. Lithologic variations and weaknesses in rocks caused by bedding partings, joints, cleavage, and faults may promote rapid weathering and produce low areas in the topography. These types of geologic features often occur in high-permeability zones which yield significant amounts of water to wells.

Figure 14 is a graph showing the percent frequency distribution of nondomestic well yields from the Appalachian Mountain physiographic section that have been grouped according to topographic setting. The graph shows that valley wells are generally more productive than hillside wells which, in turn, are more productive than hilltop wells. In the high range of yields, valley wells yield nearly three times as much water as hilltop wells.

Geologic Structure

Geologic structure, which includes faults, folds, fractures, and orientation (dip) of the rock layers, often has an important influence on the yield of wells. The locations of major structures are shown on Plate 1.

Faulting may create zones of fractured rock that yield substantial amounts of water. Occasionally, however, faults are filled with clay, calcite, or quartz and may yield little or no water. This is most common with faults in carbonate rocks.

Fold hinges represent areas where considerable secondary permeability may be developed because of an increase in fracture abundance, occasional well-developed cleavage, and the presence of horizontal or nearly horizontal bedding.

Wells that penetrate fractured bedrock yield more water than those that do not penetrate any fractures. As mentioned earlier, the locations of valleys and draws are frequently controlled by fractures or fracture zones. Other features reported to be good indicators of fractured bedrock are faults and fracture traces (natural linear features observed on aerial photo-

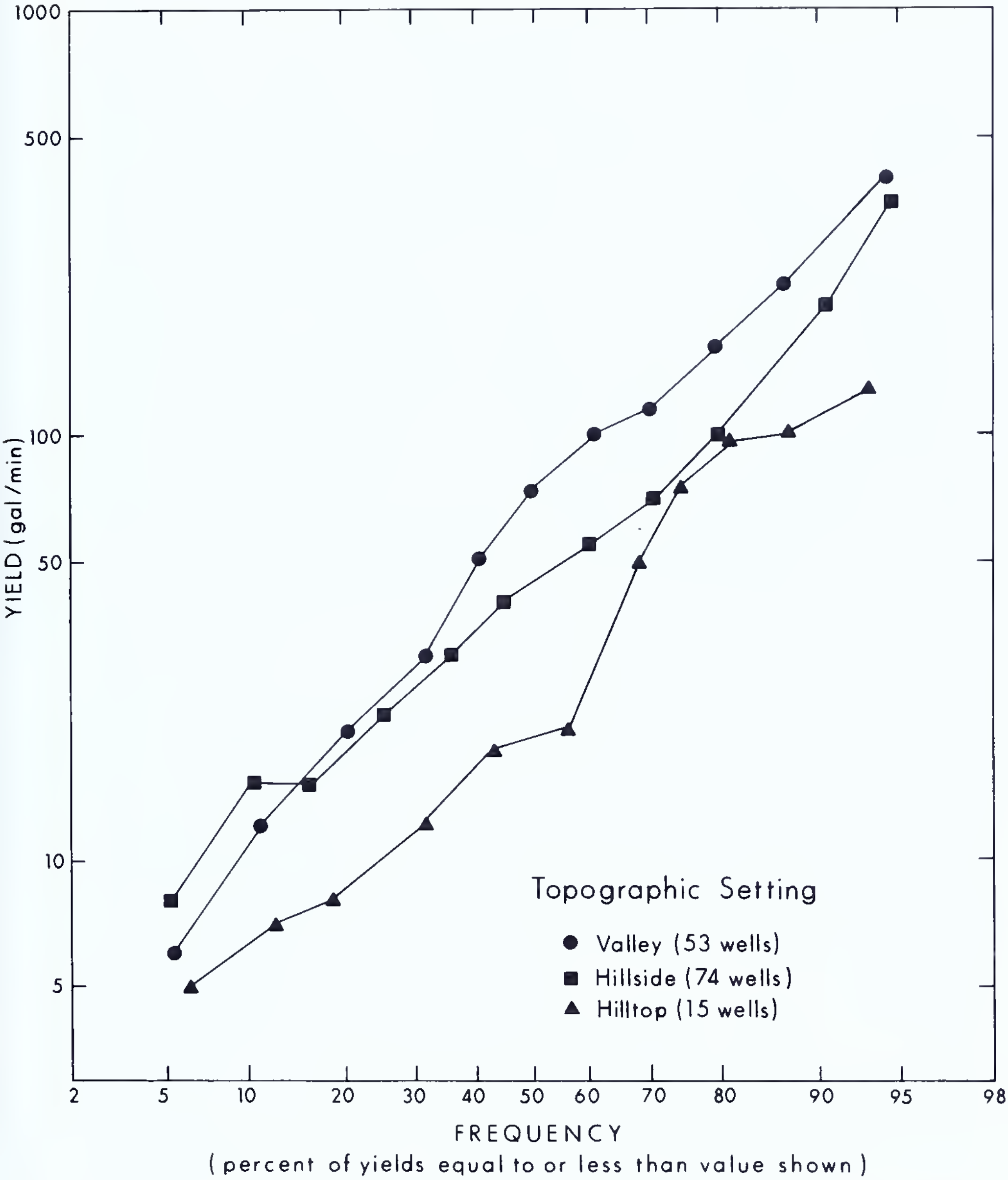

Figure 14. Percent frequency distribution of nondomestic well yields from the Appalachian Mountain section, grouped according to topographic setting.

graphs that may be the surface expression of fracture zones in the subsurface).

Well yields generally increase with decreasing dip of strata because more of the openings that normally occur between beds (bedding-plane partings) are penetrated by a well in nearly horizontal strata than in steeply inclined strata.

GROUNDWATER QUALITY

The amount and type of dissolved mineral matter in groundwater is determined largely by the composition of the soil and rock through which the water flows and the length of time the water has been in contact with the soil and rock. Thus differences exist in the concentrations of dissolved constituents in groundwater, depending on both the geologic unit from which the water is obtained and on the position of the water within the groundwater flow system. Table 13 is a list of the principal mineral constituents that occur in the groundwater of the basin and their source and significance.

The quality of groundwater within the Lower Susquehanna River basin was evaluated using 369 samples collected from wells and springs and analyzed in the laboratory of the Department of Environmental Resources. An additional 458 analyses compiled by Koester and Miller (1982) were used to supplement the data for the rock units located to the south of Blue Mountain. Median values for each constituent analyzed are given in Table 14 by aquifer and physiographic location. A complete listing of the analyses is given in Table 19. The water quality by aquifer is discussed in the section entitled "Stratigraphy and Water-Bearing Properties of the Rocks."

The analysis of the water-quality data indicates that a major difference in quality occurs between groundwater from rock units that are primarily calcareous as compared with those that are noncalcareous. Table 15 summarizes the analyses according to dominant rock type for wells located in the Appalachian Mountain section of the Valley and Ridge province.

The median hardness from units composed mainly of limestone or calcareous shale is 180 mg/L (milligrams per liter) as compared to a median of only 64 mg/L for water from units composed predominantly of noncalcareous siltstone and sandstone. Several other constituents consistently present in greater concentrations in the calcareous units are calcium, dissolved solids, magnesium, and nitrate.

Additional information on hardness, specific conductance, and pH in the Appalachian Mountain section was obtained from the 426 field analyses summarized in Table 16. The occurrence of these and other common constituents in groundwater is described in the following sections.

SPECIFIC CONDUCTANCE AND TOTAL DISSOLVED SOLIDS

The specific conductance of groundwater depends on the amount and, to a lesser degree, type of dissolved constituents. Thus specific conductance can be used to make an approximate estimate of the total dissolved solids. Figure 15 shows the relationship between field measurements of specific conductance and laboratory measurements of total dissolved solids for northern Dauphin County. According to this relationship, the dissolved solids can be obtained by multiplying the specific conductance by 0.65 and

Table 13. ***Source and Significance of Selected Dissolved Constituents and Properties of Groundwater***[1]
(Concentrations are in milligrams per liter (mg/L) except as indicated)

Constituent or property	Source or cause	Significance[2]
Silica (SiO_2)	Dissolved from practically all rocks and soils (commonly less than 30 mg/L).	Forms hard scale in pipes and boilers. When carried over in steam of high-pressure boilers it forms deposits on blades of turbines.
Aluminum (Al)	Dissolved in small quantities from aluminum-bearing rocks. Acid waters often contain large amounts.[3]	May be troublesome in feed waters by forming scale on boiler tubes. High concentrations generally indicate the presence of acid mine drainage or industrial waste.[3] In natural water, it rarely occurs in concentrations greater than a few tenths of a milligram per liter.
Iron (Fe)	Dissolved from practically all rocks and soils. May also be derived from iron pipes, pumps, and other equipment.	On exposure to air, iron in groundwater oxidizes to a reddish-brown precipitate. More than about 0.3 mg/L stains laundry, porcelain, and utensils reddish brown. Objectionable for food processing, textile processing, beverages, ice manufacturing, brewing, and other processes. Maximum limit recommended for drinking water is 0.3 mg/L.
Manganese (Mn)	Dissolved from many rocks and soils. Often found associated with iron in natural waters, but is not as common as iron.	More than 0.2 mg/L precipitates upon oxidation. Manganese has the same undesirable characteristics as iron but is more difficult to remove. Maximum limit recommended for drinking water is 0.05 mg/L.
Cadmium (Cd)	Dissolved in small quantities from cadmium-bearing rocks. Excessive concentrations are generally due to contamination by industrial wastes from metal-plating operations.	Concentrations above 0.01 mg/L may be toxic and are considered grounds for the rejection of a water supply.
Chromium (Cr)	Dissolved in minute quantities from chromium-bearing rocks. Excessive concentrations are generally due to contamination by industrial wastes.	Maximum limit recommended for drinking water is 0.05 mg/L.

Table 13. *(Continued)*

Constituent or property	Source or cause	Significance[2]
Lead (Pb)	Dissolved in small quantities from lead-bearing rocks. Less than 0.01 mg/L is generally found in natural waters. Excessive concentrations can be caused by corrosion of lead plumbing.	Lead is accumulated by the body and causes sickness and even death in excessive concentrations. Maximum limit recommended for drinking water is 0.05 mg/L.
Zinc (Zn)	Dissolved from zinc-bearing rocks. May be dissolved from galvanized pipe and is present in many industrial wastes.	Concentrations greater than 30 mg/L have been known to cause nausea and fainting and may impart a metallic taste and milky appearance to water. Maximum limit recommended for drinking water is 5 mg/L.
Nickel (Ni)	Dissolved from nickel-bearing rocks, commonly associated with iron and manganese.	Nickel is considered to be relatively nontoxic to man.
Arsenic (As)	Dissolved in small quantities from arsenic-bearing rocks. Excessive concentrations are generally due to improper waste-disposal practices. Arsenic is also present in certain insecticides and herbicides.	Concentrations above 0.05 mg/L may be toxic and are considered grounds for rejection of a water supply. The typical concentration in groundwater is less than 0.001 mg/L.
Calcium (Ca) and magnesium (Mg)	Dissolved from practically all rocks and soils, especially from limestone, dolomite, and gypsum.	Cause of most of the hardness and, in combination with bicarbonate, is the cause of scale formation in steam boilers, water heaters, and pipes (see "Hardness"). Water low in calcium and magnesium is desired in electroplating, tanning, dyeing, and textile manufacturing.
Sodium (Na) and potassium (K)	Dissolved from practically all rocks and soils. Sewage and industrial wastes are also major sources.	Concentrations of less than 50 mg/L have little effect on the usefulness of water for most purposes. More than 50 mg/L may cause foaming in steam boilers and limit the use of water for irrigation.
Alkalinity (CO_3, HCO_3)	The bicarbonate ion may result from atmospheric carbon dioxide and the solution of carbon dioxide produced during the decomposition of organic matter in the soil. The major source, however, is from the solution of limestone.	Bicarbonate (HCO_3) and carbonate (CO_3) produce alkalinity. Bicarbonates of calcium and magnesium decompose in steam boilers and hot-water facilities to form scale and release corrosive carbon dioxide gas (see "Hardness").

Sulfate (SO_4)	Dissolved from rocks and soils containing gypsum, iron sulfides, and other sulfur compounds. Commonly present in some industrial wastes and sewage.	Sulfates in water containing calcium may form hard calcium sulfate scale in steam boilers. The maximum limit recommended for drinking water is 250 mg/L.
Chloride (Cl)	Dissolved from rocks and soils in small quantities. Relatively large amounts are derived from sewage, industrial wastes, and highway salting practices.	In large quantities chloride increases the corrosiveness of water. Large amounts in combination with sodium give a salty taste. Maximum limit recommended for drinking water is 250 mg/L.
Fluoride (F)	Dissolved in small to minute quantities from most rocks and soils.	About 1.0 mg/L of fluoride in drinking water is believed to be helpful in reducing the incidence of tooth decay in small children; larger concentrations cause mottling of enamel. It is recommended that fluoride not exceed 2.0 mg/L where the average daily maximum air temperature is 58.4 to 63.8 °F.
Nitrite (NO_2)	Found in sewage and other organic wastes. Unstable in the presence of oxygen, and only present in small amounts in most waters.[3]	Presence of nitrite is generally an indication of organic pollution. Undesirable in waters for some dyeing and brewing processes.[3]
Nitrate (NO_3)	Decaying organic matter, sewage, and fertilizers are principal sources.	The maximum limit recommended for drinking water is 10 mg/L of NO_3 as N. Waters containing more than this level may cause methoglobinemia (a disease often fatal in infants) and, therefore, should not be used in infant feeding. Small concentrations have no effect on usefulness of water. Most groundwaters contain less than 10 mg/L of NO_3 as N.
Ammonia nitrogen (NH_3)	Found in many waters but usually only in trace amounts. Found in waters polluted with sewage and other organic waste.[3]	Generally indicates organic pollution. Ammonium salts are destructive to concrete made from portland cement and toxic to freshwater aquatic life in concentrations in excess of 0.02 mg/L.[4]
Phosphate (PO_4)	Dissolved in very small quantities from most rocks and soils. The chief sources are fertilizer and detergents.	Concentrations much greater than local averages may indicate contamination from phosphate detergents and/or fertilizers.

Table 13. *(Continued)*

Constituent or property	Source or cause	Significance[2]
Hardness (as $CaCO_3$)	In most waters nearly all of the hardness is due to calcium and magnesium. All of the metallic cations other than the alkali metals also cause hardness. There are two classes of hardness — carbonate (temporary) and noncarbonate (permanent). Carbonate hardness refers to the hardness resulting from cations in association with carbonate and bicarbonate; it is called temporary because it may be removed by boiling the water. Noncarbonate hardness refers to that resulting from cations in association with other anions.	Hardness consumes soap before a lather will form and deposits soap curds on bathtubs. Carbonate hardness is the cause of scale formation in boilers, water heaters, radiators, and pipes, resulting in a decrease in heat transfer and restricted flow of water. Waters of hardness up to 60 mg/L are considered soft; 61 to 120 mg/L, moderately hard; 121 to 180 mg/L, hard; and more than 180 mg/L, very hard. Very soft water that has a low pH may be corrosive to plumbing. The number of milligrams per liter divided by 17.1 yields the concentration in grains per gallon.
Dissolved solids — A measure of all of the chemical constituents dissolved in a particular water. The maximum limit recommended for drinking water is 500 mg/L, but water containing up to 1,000 mg/L may be used where less mineralized supplies are not available.		
Specific conductance (micromhos at 25° C) — A measure of the capacity of a water to conduct an electrical current. It varies with concentration and degree of ionization of the constituents. May be used to obtain a rapid estimate of the approximate dissolved-solids content of water.		
pH — The negative logarithm of the hydrogen-ion concentration. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkaline solutions; values lower than 7.0 indicate acidic solutions. Corrosiveness of water generally increases with decreasing pH. The pH of most natural water ranges between 6 and 8.		
Temperature — The temperature of groundwater that occurs between the water table and about 60 feet below the water table is approximately the same as the average annual air temperature (Lovering and Goode, 1963, p. 5); below this point, groundwater temperatures increase with depth about 1° F for each 50 to 100 feet.		

[1] Lloyd and Growitz (1977), p. 51-54.

[2] Recommended drinking-water limits are from U.S. Environmental Protection Agency (1975, 1977).

[3] Ward and Wilmoth (1968), p. 20-22.

[4] U.S. Environmental Protection Agency (1976), p. 10.

Table 14. Median Chemical Analyses of Groundwater by Aquifer and Physiographic Location

(Quantities are in milligrams per liter unless otherwise indicated)

Group, formation, or member[1]	Number of samples[2]	pH (units)	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
APPALACHIAN MOUNTAIN SECTION																								
Llewellyn Formation	4	6.7	.001	.06	66	.001	29.5	4.0	.01	139	.1	100	.99	.002	.16	6.8	.01	.16	.01	.02	.35	7.2	5	.09
Mauch Chunk Formation	26	6.7	.002	.03	8	.001	31.5	7.0	.01	174	.1	95	.05	.001	.01	3.1	.01	.01	.01	3.40	.40	6.0	10	.03
Pocono Formation	1	6.4	.003	.08	44	<.001	26.0	5.0	<.01	122	.2	64	.03	.003	.02	2.4	<.01	<.01	<.01	.98	.30	3.9	30	.02
Catskill Formation[3]	38	6.6	.006	.04	65	.001	10.5	3.5	.01	119	.1	57	.08	.002	.02	5.8	.01	.02	.01	.59	.70	7.3	5	.02
Sherman Creek Member of Catskill Formation	18	6.6	.004	.04	62	.001	8.8	4.0	.01	115	.1	52	.06	.003	.01	5.6	.01	.01	.01	.66	.70	6.9	5	.03
Irish Valley Member of Catskill Formation	13	6.8	.004	.05	78	.001	11.0	2.0	.01	116	.2	61	.26	.002	.11	6.7	.01	.05	.01	.10	.50	10.0	5	.01
Trimmers Rock Formation	18	6.5	.001	.05	58	<.001	12.0	2.5	<.01	93	.1	55	.18	.002	.04	4.4	<.01	.03	<.01	.20	.30	4.1	5.0	.02
Hamilton Group[4]	23	6.7	.001	.04	66	.001	16.0	2.0	<.01	128	.1	60	.19	.002	.08	5.1	.01	.06	<.01	.02	.40	6.5	10	.03
Mahantango Formation	17	6.7	.010	.04	66	.001	16.0	3.0	.01	136	.2	60	.20	.002	.09	5.1	.01	.06	.01	.02	.40	7.5	10	.03
Onondaga and Old Port Formations, undivided	1	6.8	.001	.07	54	<.001	.1	6.0	.01	128	<.1	7	.03	.001	.01	<.1	.03	.37	<.01	.02	<.10	32.0	10	.01
Keyser and Tonoloway Formations, undivided	7	7.5	.001	.03	160	.001	46.0	3.0	.01	206	.1	180	.09	.004	.01	15.0	.01	.01	.01	2.30	.70	3.2	15	.02
Wills Creek Formation	8	7.8	.001	.06	135	.001	35.0	3.5	.01	200	.1	155	.08	.004	.01	12.5	.01	.01	.01	1.85	.70	1.4	12	.04
Bloomsburg and Mifflintown Formations, undivided	4	6.6	.002	.06	61	.001	13.0	3.0	.01	87	.2	30	.86	.004	.04	3.1	.02	.02	.01	.29	.50	2.3	10	.06

Table 14. *(Continued)*

Group, formation, or member[1]	Number of samples[2]	pH (units)	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_4, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
Clinton Group	2	8.2	.006	.04	139	.002	7.6	1.0	.02	187	.4	45	.07	.026	.02	3.8	.02	.03	.01	.02	5.15	50.7	25	.02
Juniata Formation	1	7.9	.010	.09	60	<.03	9.8	8.0	—	94	<.1	66	.12	<.05	.01	7.0	<.01	.01	<.01	.16	1.00	4.7	3	.02
Reedsville Formation	2	7.5	.008	.06	138	.002	42.0	8.0	.01	208	.3	140	.02	.028	<.01	7.2	.02	.16	.01	.07	.60	8.4	13	.01
Coburn Formation through Loysburg Formation, undivided	4	7.5	<.01	.08	205	<.003	75.0	3.5	<.01	400	.2	290	.07	<.005	.01	6.5	.01	.02	<.01	1.85	1.30	3.4	18	.04
Bellefonte Formation	1	7.5	<.005	.08	170	<.001	33.0	10.0	<.01	248	.2	180	.01	<.005	<.01	23.0	.02	.01	<.01	2.00	1.00	2.5	10	.01
GREAT VALLEY SECTION (west of Susquehanna River)																								
Martinsburg Formation	13-30	7.3	<.001	.06	110	<.001	30	5.0	<.01	211	.2	130	.24	.002	.26	12	.01	.12	<.01	.04	1.0	8.0	27	.02
Hamburg sequence	1-3	7.6	.002	.10	134	<.001	60	4.0	<.01	255	.1	180	.08	.001	.03	9.9	—	.08	<.01	.22	.5	6.5	55	.02
Chambersburg Formation	1-2	7.2	—	.004	274	<.015	124	125	<.005	614	.4	439	.44	<.005	.02	31	<.005	—	—	.58	1.4	42	62	1.70
St. Paul Group	1-8	7.1	<.001	.08	256	<.001	100	33	.01	398	.2	320	.32	.007	.01	13	.02	.03	<.01	4.86	2.6	14	33	.02
Pinesburg Station Formation	0-2	7.3	—	—	260	—	100	11	—	375	.2	340	.15	—	<.01	21	—	—	—	7.6	2.4	3.7	24	—
Rockdale Run Formation	1-18	7.4	<.001	.18	233	<.003	99	18	<.01	370	.2	298	.23	.002	.04	16	.01	.05	<.01	3.5	3.1	10	24	.18
Stonehenge Formation	0-1	7.3	—	—	185	—	90	8.1	—	284	.3	280	.03	—	<.01	13	—	—	—	3.84	1.6	2.9	19	—
Shadygrove Formation	0-3	7.4	—	—	182	—	75	3.7	—	261	.2	230	.01	—	<.01	9.4	—	—	—	4.4	1.0	1.1	13	—
Zullinger Formation	3-7	7.1	<.001	.07	232	<.001	93	7.4	<.01	322	.2	270	.05	.002	.01	11.2	.02	.015	<.01	5.9	3.0	6.0	20	.11
Elbrook Formation	2-9	7.5	<.001	.08	193	<.001	50	6.2	.01	277	.2	230	.06	.002	.01	17	.02	.04	<.01	5.2	1.6	2.0	28	.05
Waynesboro Formation	0-1	7.3	—	—	190	—	63	26	—	285	.2	220	.04	—	.03	15	—	—	—	3.16	1.7	8.5	15	—
Tomstown Formation	0-4	7.8	—	—	82	—	26	1.7	—	112	.2	97	.27	—	.01	7.9	—	—	—	1.4	1.1	85	4.8	—

(east of Susquehanna River)

Martinsburg Formation	6-8	7.0	.001	.04	106	<.001	34	6.3	<.01	200	.2	110	.28	.002	.12	7.4	<.01	.07	<.01	.08	.5	8.3	8.5	.04
Hamburg sequence	63-97	7.4	.001	.06	105	<.001	36	6	<.01	178	.1	130	.14	.002	.06	8.2	.01	.06	<.01	.35	.8	6.8	15	.03
Ontelaunee Formation	0-3	7.5	—	—	210	—	88	14	—	395	.0	330	.12	—	.02	20	—	—	—	1.20	1.4	13.4	72	—
Epler Formation	3-5	6.9	.002	.04	226	<.001	86	30	.02	462	.2	310	.06	.003	.01	19	.01	.06	<.01	4.92	4	15	34	.48
Stonehenge Formation	0-6	7.4	—	—	215	—	86	9.1	—	341	.1	280	.14	—	.01	16	—	—	—	5.09	1.9	5.7	30	—
Richland Formation	0-3	7.2	—	—	221	—	75	6.8	—	312	.2	290	.05	—	<.01	26	—	—	—	5.20	4.6	7.1	52	—
Millbach and Shaefferstown Formations, undivided	0-7	7.7	—	—	190	—	71	6.2	—	296	.2	240	.05	—	.03	15	—	—	—	5.66	2.8	3.3	26	—
Snitz Creek Formation	2-8	7.6	<.005	.08	242	<.001	69	13	<.01	367	.1	295	.07	<.005	.04	33	.02	.33	<.01	4.98	4.2	5.2	45	.02
Buffalo Springs Formation	2-7	7.5	.002	.05	250	<.001	88	19	<.01	444	.1	300	.06	.003	.01	26	.02	.04	<.01	8.14	3.4	11	41	.07
BLUE RIDGE PROVINCE																								
Antietam Formation	0-3	6.2	—	—	8	—	2.8	1.5	—	36	.0	16	.67	—	.03	2.2	—	—	—	.11	1.7	.8	10	—
Metarhyolite	0-2	6.9	—	—	14	—	2.5	1.3	—	43	.0	11	1.44	—	.05	1.2	—	—	—	.72	1.6	3.9	3.9	—
TRIASSIC LOWLAND SECTION																								
Diabase	0-23	7.3	—	—	98	—	38	9.0	—	253	.0	170	.11	—	.01	18	—	—	—	2.3	1.3	7.9	38	—
Gettysburg Formation	18-76	7.1	.002	.08	110	<.001	45	9.0	<.01	236	<.1	155	.07	.003	<.01	9.5	.01	.01	<.01	2.49	1.0	9.0	25	.03
Hammer Creek Formation	6-11	6.4	.001	.07	40	<.001	19	6.0	.01	136	.1	64	.09	.004	.02	3.4	.02	.06	<.010	1.9	.6	5.6	5	.04
New Oxford Formation	5-73	7.2	.001	.07	103	<.001	46	9.4	.01	206	.0	140	.08	.001	.01	8.1	.01	.01	<.01	5.31	1.1	9.4	24	.03
CONESTOGA VALLEY SECTION																								
Cocalico Formation	8-8	6.8	.001	.07	64	<.001	34	10.0	.01	200	<.1	110	.07	<.005	.03	5.5	.02	.06	<.01	3.5	.80	4.6	35	.03
Ontelaunee Formation	1-1	7.5	.003	.07	200	<.001	86	23.0	.01	416	<.1	280	.05	.002	<.01	16.0	.02	.01	<.01	16.0	1.0	7.1	17	.12
Epler Formation	5-18	7.4	.001	.10	222	<.001	88	15	.01	387	<.1	295	.08	.003	.01	19	.02	.06	<.01	8.71	2.0	6.0	26	.04
Stonehenge Formation	1-8	7.4	.003	.04	216	<.001	97	15	<.01	357	.0	290	.02	.004	<.01	12	—	.01	<.01	10.1	2.2	6.6	24	.05
Conestoga Formation	6-26	7.4	.002	.08	194	<.001	95	21	.01	435	.1	300	.10	<.005	<.01	16	.01	.04	<.01	10.1	2.4	9.1	53	.05
Millbach Formation	1-2	7.4	.001	.20	271	<.001	96	18	.01	430	.4	360	.14	<.001	.02	24	.04	.05	<.01	8.33	8.0	6.2	51	.04
Snitz Creek Formation	1-1	7.4	.001	.20	210	<.001	65	12	.01	304	.6	300	.08	.002	.01	24	.05	.08	<.01	2.9	3.0	5.3	37	.09

Table 14. (Continued)

Group, formation, or member[1]	Number of samples[2]	pH (units)	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_4, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
CONESTOGA VALLEY SECTION (*Continued*)																								
Snitz Creek and Buffalo Springs Formations, undivided	2-2	7.4	.002	.15	270	<.001	99	18	.02	652	<.1	395	.04	.006	.02	36	.02	.05	<.01	17.6	3.0	4.8	40	.03
Buffalo Springs Formation	1-4	7.6	<.001	.08	225	<.001	74	9	.01	348	.2	325	.04	.001	.01	30	.02	.01	<.01	8.13	4.2	5.3	38	.10
Zooks Corner Formation	3-5	7.3	.001	.08	340	<.001	114	99	.01	878	.1	550	.05	.001	.02	72	.02	.09	<.01	16.1	9.0	36	65	.30
Elbrook Formation	0-3	7.5	—	—	212	—	78	56	—	483	.1	300	.15	—	—	34	—	—	—	7.46	3.2	13	48	—
Ledger Formation	7-18	7.6	.001	.08	235	<.001	66	22	.01	394	<.1	305	.06	.003	.01	34	.01	.06	<.01	9.4	2.4	5.9	25	.09
Kinzers Formation	4-11	7.8	.001	.06	173	<.001	59	22	.01	308	<.1	240	.05	.004	.01	17	.02	.04	<.01	4.07	1.9	15	31	.06
Vintage Formation	3-8	7.8	.001	.07	198	<.001	66	24	.01	400	<.1	250	.04	<.005	.01	22	.02	.01	<.01	5.77	2.0	7.2	30	.06
Antietam Formation	5-10	7.4	.001	.08	64	<.001	22	10	.01	136	.1	95	.10	.002	.02	6.2	<.01	.01	<.01	3.58	2.0	8.0	20	.03
Harpers Formation	6-14	7.0	.001	.08	41	<.001	21	14	<.01	171	<.1	86	.06	.003	.09	7.8	.02	.01	<.01	2.4	1.8	10	25	.04
Chickies Formation	3-15	6.1	.001	.07	5	<.001	2.9	3.0	<.01	53	.1	20	.12	.013	.03	2.2	.01	.06	<.01	.84	1.0	3.4	5.0	.05
PIEDMONT UPLANDS SECTION																								
Granitic gneiss and granite	4-4	6.3	.002	.08	36	<.001	24	23	.01	236	<.1	110	.08	.006	.02	8.7	.01	.01	<.01	4.60	3.0	6.6	20	.03
Serpentinite	0-2	—	—	—	14	—	20	42	—	188	—	92	.36	—	—	10	—	—	—	13.2	2.1	24	4.7	—
Peach Bottom Slate	0-3	7.1	—	—	11	—	5.6	8.0	—	88	<.1	19	.43	—	.02	1.5	—	—	—	5.2	.6	4.2	1.8	—
Peters Creek Schist	10-23	6.1	<.001	.06	20	<.001	8.5	8.0	.01	87	<.1	47	.09	.006	.02	4.2	.01	.05	<.01	4.98	.6	4.7	4	.05
Wissahickon Formation	25-65	6.4	.001	.09	13	<.001	9.5	10	.01	116	<.1	47	.09	.005	.03	4.2	.02	.06	<.01	7.35	.9	4.5	5	.04
Marburg Schist	5-15	7.2	.001	.08	18	<.001	9.8	6.8	.01	86	<.1	35	.10	.006	.02	3.5	.02	.01	<.01	3.16	.8	3.9	8.0	.05
Gabbroic gneiss and gabbro	1-1	7.6	.001	.03	96	<.001	46	9.8	<.01	262	<.1	140	.06	.002	.17	6.9	—	.01	<.01	.10	5	4.8	35	.05

[1] Only those units for which data were obtained are listed.

[2] The first number is the number of samples analyzed in this study; the second number is the maximum number of analyses used to obtain the median for certain common constituents: pH, alkalinity, calcium, chloride, dissolved solids, fluoride, hardness, iron, manganese, magnesium, nitrate, potassium, sodium, and sulfate. The supplemental data are from Koester and Miller (1982).

[3] Includes data from the Sherman Creek and Irish Valley Members

Table 15. Summary of Chemical-Quality Characteristics of Groundwater from Predominantly Calcareous and Pre-

Table 15. ***Summary of Chemical-Quality Characteristics of Groundwater from Predominantly Calcareous and Predominantly Noncalcareous Rock Units in the Valley and Ridge Physiographic Province***

	Predominantly noncalcareous units				Predominantly calcareous units			
	Number of		Concentration[1]		Number of		Concentration[1]	
Constituents (mg/L)	samples	Minimum	Median	Maximum	samples	Minimum	Median	Maximum
pH	115	5.9	6.8	9.4	21	6.8	7.6	8.1
Arsenic	113	.001	.002	.048	21	.001	.001	.003
Aluminum	115	<.01	.04	.23	21	.01	.06	.10
Alkalinity ($CaCO_3$)	115	10	68	210	21	54	160	340
Cadmium	114	<.001	<.001	<.001	21	<.001	<.001	<.001
Calcium	115	.30	14.0	65.0	21	.1	42.0	170
Chloride	115	<1.0	3.0	330	21	<1.0	3.0	21
Chromium	114	<.01	<.01	.07	21	<.01	.01	.05
Dissolved solids	113	2.0	130	846	21	106	200	976
Fluoride	112	<.1	.1	2.2	21	<.1	.1	.2
Hardness ($CaCO_3$)	115	2	64	270	21	7	180	640
Iron	115	<.01	.09	2.0	20	<.01	.09	1.0
Lead	113	.001	.002	.026	21	.001	.004	.007
Manganese	115	<.001	.02	.44	21	<.01	.01	.06
Magnesium	115	.02	4.3	15.0	21	<.1	9.5	33
Nickel	114	<.01	<.01	.06	21	<.01	.01	.03
NH_3, as N	115	<.01	.02	.06	21	<.01	.01	.37
NO_2, as N	115	<.01	<.01	.09	21	<.01	<.01	<.01
NO_3, as N	115	<.02	.38	13.0	21	.02	1.90	15.0
Potassium	114	<.01	.40	10	21	<.10	.70	3.0
Sodium	115	1.4	7.1	110	21	.10	2.3	32.0
Specific conductance	108	50	179	850	18	180	315	1,230
Sulfate	115	1	5	45	21	<5	15	110
Zinc	115	.001	.02	4.0	21	.01	.03	.11

[1] Concentrations are in milligrams per liter, except specific conductance (micromhos) and pH (units).

Table 16. *Summary of Field Water-Quality Measurements from the Valley and Ridge Physiographic Province*

Group, formation, or member[1]	Type[2]	pH (units)				Hardness (gr/gal)				Specific conductance (micromhos)			
		No. of wells	Percent[3] 25	Percent[3] 50 (median)	Percent[3] 75	No. of wells	Percent[3] 25	Percent[3] 50 (median)	Percent[3] 75	No. of wells	Percent[3] 25	Percent[3] 50 (median)	Percent[3] 75
Llewellyn	D	5	6.1	7.4	7.8	5	4	5	8	5	152	200	528
Formation	N	2	—	7.4	—	2	—	4	—	2	—	190	—
Mauch Chunk	D	43	6.1	6.9	7.6	71	2	5	6	71	116	220	290
Formation	N	10	5.9	6.9	7.6	11	2	3	7	7	80	120	197
Catskill	D	7	6.0	6.3	7.3	63	3	3	5	61	120	155	205
Formation[4]	N	3	—	7.3	—	2	—	6	—	1	—	195	—
Sherman Creek	D	4	—	6.2	—	31	2	3	4	31	105	150	205
Member of Catskill Formation	N	—	—	—	—	—	—	—	—	—	—	—	—
Irish Valley	D	1	—	7.4	—	23	3	4	5	21	110	177	220
Member of Catskill Formation	N	1	—	7.3	—	—	—	—	—	—	—	—	—
Brallier and	D	—	—	—	—	5	2	3	4	5	135	170	205
Harrell Formations, undivided	N	—	—	—	—	—	—	—	—	—	—	—	—
Trimmers Rock	D	7	6.5	7.2	7.7	22	3	4	4	20	92	155	205
Formation	N	—	—	—	—	2	—	4	—	2	—	134	—
Hamilton	D	16	6.7	7.2	7.7	39	3	4	6	39	130	185	250
Group	N	5	6.7	7.1	7.4	3	—	10	—	2	—	228	—
Onondaga and	D	7	5.9	6.8	7.4	10	2	7	8	10	170	285	365
Old Port Formations, undivided	N	1	—	7.2	—	1	—	16	—	1	—	560	—

Keyser and Tonoloway Formations, undivided	D	11	7.1	7.2	7.5	20	8	12	15	20	305	405	580
	N	4	—	7.4	—	—	—	—	—	—	—	—	—
Wills Creek Formation	D	36	7.2	7.5	7.6	48	8	11	16	48	285	420	560
	N	9	7.2	7.4	7.7	7	9	10	13	7	360	400	510
Bloomsburg and Mifflintown Formations, undivided	D	20	6.6	7.1	7.7	33	3	5	7	31	170	215	325
	N	2	—	7.0	—	1	—	4	—	1	—	180	—
Clinton Group	D	2	—	7.2	—	7	4	4	7	7	120	250	270
	N	4	—	7.2	—	—	—	—	—	—	—	—	—
Juniata Formation	D	2	—	7.9	—	2	—	3	—	1	—	155	—
	N	2	—	6.6	—	2	—	2	—	—	—	—	—
Reedsville Formation	D	—	—	—	—	7	7	7	11	7	280	320	820
	N	—	—	—	—	—	—	—	—	—	—	—	—
Coburn Formation through Loysburg Formation, undivided	D	3	—	7.5	—	9	12	16	17	9	395	515	630
	N	—	—	—	—	—	—	—	—	—	—	—	—

[1] Includes only those units for which data were obtained.
[2] D, domestic; N, nondomestic.
[3] Percentage of wells that have values less than or equal to the value shown.
[4] Includes data from the Irish Valley and Sherman Creek Members.

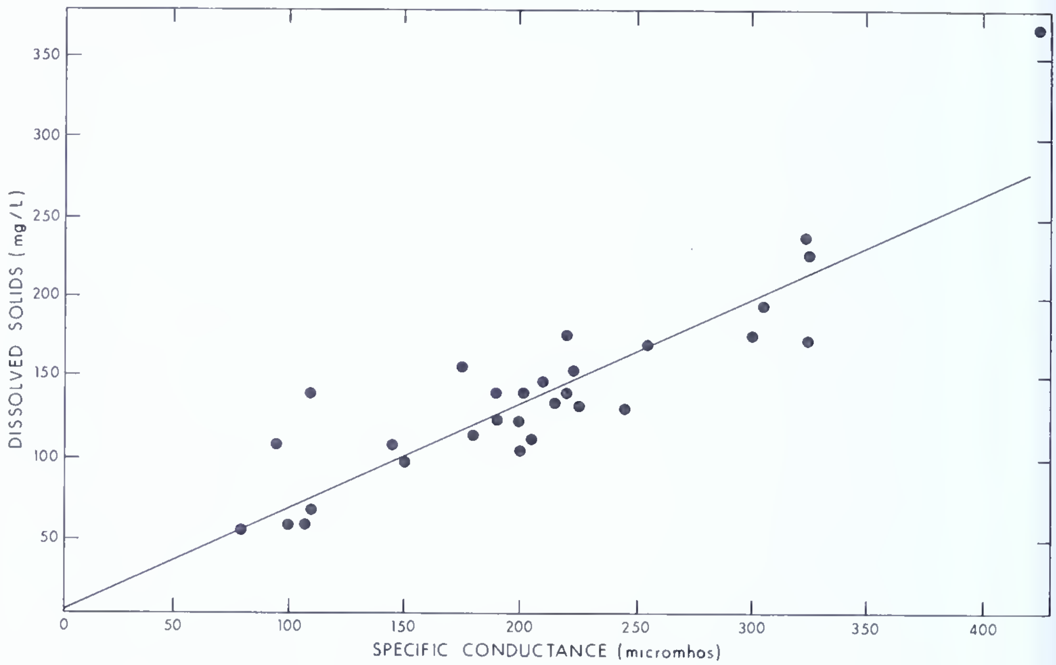

Figure 15. Specific conductance versus dissolved solids for northern Dauphin County (dissolved solids = 0.65 × specific conductance + 3).

adding 3. This agrees well with factors obtained in other studies, which are generally between 0.6 and 0.65 times the specific conductance.

The recommended limit for dissolved solids in drinking water is 500 mg/L (U.S. Environmental Protection Agency, 1975), which is equivalent to a specific conductance of about 775 micromhos. Fifty-four of the 827 samples analyzed for dissolved solids in the laboratory (or about 6.5 percent) exceed the U.S. Environmental Protection Agency (EPA) limit. Less than 3 percent of the 426 field analyses of specific conductance from the Appalachian Mountain section indicate a dissolved-solids content above the limit. Most of the high values for dissolved solids are from rock units that consist primarily of the carbonate minerals (limestone and dolomite). Over 13 percent of the samples from the Conestoga Valley section, a large part of which is underlain by carbonate rocks, have more than 500 mg/L dissolved solids.

Water that contains an excessive amount of dissolved solids can be treated by a process called reverse osmosis. However, household treatment units that incorporate this process are suitable for small quantities of water and are generally practical for only a single faucet in a home.

HARDNESS

Hardness in water is a measure of the water's resistance to sudsing and is primarily caused by the presence of calcium and magnesium ions. Median

values of hardness from laboratory and field measurements are given in Tables 15 and 16, respectively. The field measurements are reported in grains per gallon (gr/gal) rather than milligrams per liter because the field method is only accurate to ±1 gr/gal. To state the results in milligrams per liter would imply a false accuracy. The approximate milligrams per liter may be obtained by multiplying the number of grains per gallon by 17.1.

The inset on Plate 1 is a map showing the distribution of groundwater hardness within the Lower Susquehanna River basin. In general, groundwater is hardest from limestone and dolomite in the Conestoga Valley and Great Valley sections, and in some major valleys in the Appalachian Mountain section. Hard water also occurs in parts of the Triassic Lowlands. Comparatively soft water occurs under ridges, hillsides, and other areas underlain by sandstone and shale in the Appalachian Mountain section, in the Blue Ridge province, and in the Piedmont Uplands section.

If desirable, hard water may be softened by removing the minerals, primarily calcium and magnesium, that cause hardness. Ion-exchange water softeners are the most commonly used means of softening water; however, the ion-exchange process results in an increase in the sodium content of the water, which may make the water unsuitable for people on a low-sodium diet.

IRON AND MANGANESE

Iron and manganese have a similar chemical behavior and are commonly present in groundwater in small concentrations. If the concentration of iron exceeds 0.3 mg/L or the concentration of manganese exceeds 0.2 mg/L, staining of plumbing fixtures and cooking utensils may occur.

Samples containing objectionable amounts of iron were collected from almost every rock unit, but were most frequent from wells located in noncalcareous shale and sandstone. All four samples collected from the coal-bearing rocks contain excessive iron and manganese. Within the non-coal-bearing rocks, the shales in the Great Valley section have the most samples exceeding the recommended limits (38 percent for iron and 59 percent for manganese).

Of the 827 samples analyzed for iron and manganese, 183 (or about 22 percent) equal or exceed EPA (U.S. Environmental Protection Agency, 1975) recommended limits for iron (0.3 mg/L) and 233 (or about 28 percent) equal or exceed recommended limits for manganese (0.05 mg/L). This indicates that iron and manganese are the constituents most often present in objectionable amounts in the groundwater of the Lower Susquehanna River basin.

The best method of removal depends on the concentration and form of the iron and manganese. Commonly used treatment methods include continuous chlorination and filtration, greensand filters, water softeners, poly-

phosphate feeders, and aeration followed by filtration or settling (Landers, 1976).

HYDROGEN SULFIDE

Many wells are reported to produce water having the "rotten egg" odor of hydrogen sulfide. No measurements were made of this constituent, but the known occurrences appear to be sporadic and unpredictable. Rock units consisting primarily of shale, such as the Martinsburg, Reedsville, and Mahantango Formations, have the highest reported incidence of water with a "rotten egg" odor. Hydrogen sulfide is distasteful but is considered to be harmless in drinking water.

Hydrogen sulfide can be removed by aeration (exposure of as much of the water surface as possible to air) or by a combination oxidation-filtration process.

NITRATE

Nitrate generally occurs in low concentrations in groundwater unaffected or only slightly affected by human activities. The median concentration of 0.38 mg/L nitrate in water from predominantly noncalcareous rock units in the Appalachian Mountain section is considerably less than the median of 1.90 mg/L for calcareous units. This relatively high median concentration is in part due to extensive fertilization of the intensively cultivated soils overlying these rock units.

About 10 percent of the samples analyzed for nitrate equal or exceed the EPA (U.S. Environmental Protection Agency, 1975) mandatory limit for nitrate of 10 mg/L as nitrogen. The majority of these high values (39) are from the Conestoga Valley section, an area in which large portions of the land are used for agriculture.

Reverse osmosis, as described for total dissolved solids, is the most common process used for removing excessive nitrate.

TRACE METALS

Measurements were made for several potentially toxic trace metals to determine their occurrence within the Lower Susquehanna River basin. The metals tested for were arsenic, cadmium, chromium, and lead. Zinc, although not considered to be toxic to humans, has been included in this category.

No areal patterns can be ascertained from the few samples that exceed mandatory drinking water limits for these constituents. Other than zinc, most of these metals are below detectable limits in most samples; however, three chromium and four lead analyses indicate levels that are higher than the limit of 0.05 mg/L. A single sample exceeds the limit for zinc of 5 mg/L.

Most of the occurrences of these constituents are probably natural in origin because of the attempt in this study to collect samples that reflect background (or uncontaminated) groundwater quality.

WATER–QUALITY PROBLEMS

The most commonly reported groundwater-quality problems in the basin are as follows, in decreasing order of prevalence: excessive iron and manganese, hydrogen sulfide, hardness, bacterial organisms from sewage, acid mine drainage, excessive nitrates, petroleum products from buried storage tanks, chlorinated solvents from degreasing operations, and landfill leachate. Most of the occurrences are local in extent and often confined to individual wells or a small area. A large number of man-induced problems could be eliminated by the use of deeper casing and by insuring that the annular opening around the exterior of the casing is tightly sealed with cement grout.

Bacterial contamination is possible in any area where on-lot waste-disposal systems are utilized. This is especially true in communities of closely spaced homes, where some wells must unavoidably be placed downslope from leach fields on adjacent lots. Also, the shallow groundwater around urban areas is often contaminated by leakage from sewer systems.

Groundwater contaminated by acid mine drainage can generally be identified by elevated amounts of iron, sulfate, and dissolved solids, and by low pH. In the parts of the anthracite region that have been deep mined for coal, much of the groundwater is contaminated. However, in many of the less disturbed areas underlain by coal, groundwater naturally has these quality characteristics. Thus, in places, the incidence of acid mine drainage pollution is not well documented because of the difficulty in determining if the water quality is natural or a result of contamination. New federal regulations requiring sampling of wells prior to and during mining should help identify the magnitude of this problem.

Hydrocarbon contamination of groundwater is most often caused by leakage of fuel oil or gasoline from buried storage tanks. Most known instances involve only a few acres and frequently occur in places where there are high concentrations of petroleum terminals and service stations.

Chlorinated solvents have been widely used as degreasers for engines and other machined parts. These compounds, which are highly soluble in water, are often discharged with other waste water into septic systems or washed directly onto the land surface. As a result, some wells located near these sites have become contaminated. Water supplies obtained from wells contaminated by chlorinated solvents must be filtered through activated carbon, or an alternate source of potable supply must be utilized.

Although a potential source of serious problems, only a few instances of landfill leachate contamination of wells have been reported. This is partly

due to the placement of landfill sites in sparsely populated localities. The known instances of contamination are in two categories: wells drilled adjacent to abandoned landfill sites, and wells located adjacent to sites in which the leachate collection and treatment facilities do not function as designed. In all cases the contaminated wells are located in relatively close proximity to the landfill site.

STRATIGRAPHY AND WATER-BEARING PROPERTIES OF THE ROCKS

The discussion that follows is organized on the basis of physiographic regions as shown in Figure 3. The rocks occurring in the physiographic provinces and sections south of Blue Mountain are described in a general way in Table 17. For detailed descriptions the primary reference listed in Table 1 should be consulted. The water-bearing properties of the rocks of the Appalachian Mountain section are described in some detail on the following pages due to the absence of any prior studies in this region.

The geology (Plate 1) and stratigraphic nomenclature in Table 17 and in the sections that follow are from the *Geologic Map of Pennsylvania* (Berg and others, 1980). Reports containing detailed stratigraphic descriptions and large-scale geologic maps were partly employed in preparing the stratigraphic discussion and should be utilized whenever detailed information is required. Figure 16 shows the locations of the areas covered by detailed geologic reports.

Table 18 is a summary of well construction and yield data by formation in the Appalachian Mountain section. This information has been combined with geologic and water-quality data to prepare the succeeding descriptions, which are arranged in order of increasing geologic age. Medians given for water-bearing properties and water-quality data approximate the most common values obtained from randomly located wells; ranges suggest the magnitude of potential values. The number of wells having reported yields of less than 5 gal/min (gallons per minute) and greater than 100 gal/min are also given. These yield amounts (less than 5 gal/min and greater than 100 gal/min) are good indicators of the potential for development of a successful domestic- or municipal-supply well, respectively. Data on water-bearing zones are useful in estimating the maximum and minimum depths to which a well should be drilled to obtain the desired yield.

The water-quality information can be used to estimate the likelihood that the water from a given rock unit will require treatment for a particular use.

LLEWELLYN FORMATION

Stratigraphy

The Llewellyn Formation consists of gray, fine- to coarse-grained sandstone, siltstone, shale, and some conglomerate and anthracite coal. The coal

Table 17. *Stratigraphy and Water-Bearing Properties of the Rock Units South of Blue Mountain*

System	Geologic unit	Geologic description	Water-bearing characteristics
		GREAT VALLEY SECTION (west of Susquehanna River)[1,2]	
Ordovician	Martinsburg Formation	Upper and lower members are chiefly dark-gray shale, separated by a middle member consisting of graywacke sandstone and siltstone; a thin zone of argillaceous limestone, limestone, and calcareous shale is present at the base. East of Carlisle the Martinsburg is replaced by a heterogeneous collection of rocks that were transported from their original depositional sites, consisting of red, green, and gray shale and siltstone, coarse sandstone and graywacke, limestone conglomerate, and limestone.	Yields sufficient quantities of water for small to moderate supplies; maximum reported well yield is 200 gal/min. Yielding zones are commonly less than 100 feet in depth, but occur as deep as 350 feet. Water often contains high concentrations of iron, manganese, and occasionally hydrogen sulfide.
	Chambersburg Formation	Dark-gray, thin- to medium-bedded, nodular limestone and minor units of thin argillaceous limestone.	Yields adequate amounts of water for small to moderate supplies; calculated median sustained yield is 11 gal/min. Water often contains high concentrations of iron and manganese.
	Saint Paul Group	Light-gray, thick-bedded, high-calcium limestone; medial zone of medium-gray, black-chert-bearing limestone and dolomite.	Yields ample amounts of water for small to moderate supplies; calculated median sustained yield is 82 gal/min. Water is very hard (median hardness is 18 gr/gal) and high in dissolved solids (median specific conductance is 720 micromhos).
	Pinesburg Station Formation	Thick-bedded, light- to medium-gray dolomite containing interbeds of blue-gray limestone.	Limited data are available; probably one of the poorer yielding units in this sequence.
	Rockdale Run Formation	Medium-bedded, very light gray, chert-bearing limestone that has a pinkish cast in the lower part; middle and upper portions consist of light-gray limestone; dolomite beds occur throughout the unit but are more abundant near the top.	Very large yields are possible; calculated median sustained yield is 405 gal/min. Most yielding zones are less than 100 feet in depth. Water is very hard (median hardness is 15 gr/gal) and high in dissolved solids (median specific conductance is 650 micromhos).

Table 17. *(Continued)*

System	Geologic unit	Geologic description	Water-bearing characteristics
Ordovician	Stonehenge Formation	Light- to medium-gray, micrograined to micritic limestone.	Limited data are available; probably yields sufficient amounts of very hard water for small to moderate supplies.
	Stoufferstown Formation	Detrital limestone containing medium to thick beds of edgewise conglomerate; thin, siliceous seams are abundant.	Limited data are available; probably one of the poorest yielding units in the carbonate rock sequence.
Cambrian	Shadygrove Formation	Light-gray to pinkish-gray micritic limestone; a few beds of sandstone, dolomitic limestone, and limestone.	Comparatively low yielding unit; median calculated sustained yield is 26 gal/min. Water is very hard (median hardness is 15 gr/gal) and high in dissolved solids (median specific conductance is 622 micromhos).
	Zullinger Formation	Medium-gray limestone and banded limestone containing siliceous seams; some thick beds of dolomite and calcareous sandstone.	Twenty percent of domestic wells rely on borehole storage to meet minimum needs; calculated median sustained yield is 82 gal/min. Water is very hard (median hardness is 14 gr/gal) and high in dissolved solids (median specific conductance is 655 micromhos).
	Elbrook Formation	Interbedded calcareous shale, argillaceous limestone, and limestone in beds a few to tens of feet thick.	Very large yields are possible; calculated median sustained yield is 218 gal/min. Yielding zones decrease significantly below a depth of 150 feet. Water is very hard (median hardness is 14 gr/gal) and high in dissolved solids (median specific conductance is 750 micromhos).
	Waynesboro Formation	Quartzitic sandstone containing thick interbeds of medium- to dark-gray, silty mudstone; probably includes some interbeds of carbonate rocks.	Limited data are available; calculated median sustained yield is 172 gal/min. Water is very hard (median hardness is 14 gr/gal) and high in dissolved solids (median specific conductance is 794 micromhos).
	Tomstown Formation	Covered with alluvium and colluvium throughout the area; massive dolomite is present in the middle of the unit; limestone, siltstone, and claystone probably occur in the lower part and possibly in [illegible]	Very large yields are possible; calculated median sustained yield is 1,050 gal/min. Overlying alluvium may cause drilling and developing prob- [illegible]

		probably occur in the lower part and possibly in the upper part.	lems. Water is hard (median hardness is 6 gr/gal) and high in dissolved solids (median specific conductance is 645 micromhos).
		GREAT VALLEY SECTION (east of Susquehanna River)[3,4,5,6]	
Ordovician	Hamburg sequence	Variable lithology; primarily gray shale with graywacke, siltstone, and claystone; contains some interbedded limestone.	Yields small to moderate amounts of water to wells; median yields of domestic wells range from about 10 to 30 gal/min; median yield of nondomestic wells is about 60 to 70 gal/min, although some parts of the unit are reported to have a median in excess of 100 gal/min. Water is generally hard (median hardness is 6 gr/gal) and contains a moderate amount of dissolved solids (median specific conductance is 240 micromhos).
	Hershey and Myerstown Formations, undivided	Hershey Formation—dark-gray argillaceous limestone; Myerstown Formation—gray, crystalline, thin-bedded limestone.	Limited data are available; reported to be poor aquifers. Water is very hard (median hardness is 14 gr/gal) and high in dissolved solids (median specific conductance is about 570 micromhos).
	Annville Formation	Light-gray, finely crystalline, thick-bedded, high-calcium limestone.	Very large yields are possible; median yield of nondomestic wells is in excess of 100 gal/min; some wells yield 1,000 gal/min or more. Water is very hard (median hardness is 18 gr/gal) and very high in dissolved solids (median specific conductance is about 760 micromhos).
	Ontelaunee Formation	Medium-dark-gray dolomite with interbeds of medium-gray limestone.	
	Epler Formation	Interbedded medium-gray limestone and dolomite containing lenses of calcarenite.	Very large yields are possible from parts of this unit; median yield of nondomestic wells is in excess of 200 gal/min; some wells yield 1,000 gal/min or more. Water is very hard (median hardness is approximately 17 gr/gal) and high in dissolved solids (median specific conductance is about 660 micromhos).

Table 17. *(Continued)*

System	Geologic unit	Geologic description	Water-bearing characteristics
Ordovician	Rickenbach Formation	Gray, cherty dolomite and subordinate limestone interbeds.	Limited data are available; median yield of four domestic wells is 18 gal/min. Water is very hard (median hardness is 14 gr/gal) and high in dissolved solids (median specific conductance is 550 micromhos).
	Stonehenge Formation	Medium-gray, crystalline limestone, cherty in the upper part; limestone conglomerate near the base.	Specific-capacity data suggest that large yields are possible; median yield of six domestic wells is 20 gal/min. Water is very hard (median hardness is 14 gr/gal) and high in dissolved solids (median specific conductance is 558 micromhos).
Cambrian	Richland Formation	Gray, thick-bedded, finely crystalline dolomite containing some interbeds of limestone and chert.	Moderate to large supplies are possible; median yield of domestic wells is 11 gal/min and the reported median yield of nondomestic wells is 200 gal/min. Water is very hard (median hardness is 14 gr/gal) and high in dissolved solids (median specific conductance is 550 micromhos).
	Millbach and Schaefferstown Formations, undivided	Millbach Formation—pinkish-gray to light-gray, laminated limestone; Schaefferstown Formation—light- to medium-gray, finely crystalline limestone.	Moderate to large supplies are possible; reported median yields of domestic and nondomestic wells are 40 and 190 gal/min, respectively. Water is very hard (median hardness is 13 gr/gal) and high in dissolved solids (median specific conductance is 505 micromhos).
	Snitz Creek Formation	Medium-gray dolomite; sandstone beds are present near the top.	Yields sufficient amounts of water for small to moderate supplies, and large supplies are possible in some areas; median yield of six domestic wells is 6 gal/min. Water is very hard (median hardness is 16 gr/gal) and high in dissolved solids (median specific conductance is 545 micromhos).

	Buffalo Springs Formation	Light- to pinkish-gray limestone interbedded with light-gray dolomite.	Medians of 10 and 82 gal/min for domestic and nondomestic wells, respectively; about 25 percent of the nondomestic wells have yields in excess of 150 gal/min. Water is hard (median hardness is 13 gr/gal) and high in dissolved solids (median specific conductance is 550 micromhos).
	Leithsville Formation	Predominantly gray dolomite containing considerable chert in the lower part; shaly in the upper part.	Limited data are available; reported median yield of 100 gal/min for three nondomestic wells in Lebanon County suggests that large yields are possible. Water is probably hard to very hard.
		BLUE RIDGE PROVINCE[7]	
Cambrian	Antietam Formation	Chiefly coarse-grained, quartzose sandstone; lower part is dense, resistant quartzite.	Limited data are available; probably yields small supplies of moderately soft water.
	Harpers Formation	Graywacke siltstone and graywacke having a prominent interval of medium- to thick-bedded, medium-grained quartzite.	Reported yields range from 5 to 25 gal/min; the median for domestic wells is 10 gal/min. Water is generally hard (median hardness is 7 gr/gal).
	Weverton Formation	Sequence of quartz phyllites, quartzose graywackes, and quartzites.	Limited data are available; yields are likely to be low because of topographic position as a ridge former.
	Loudoun Formation	Dark-gray, dusky-blue, or very dusky red purple phyllites locally interbedded with fine-grained laminated graywacke.	Limited data are available; yields are likely to be low.
Precambrian	Metabasalt[8]	Characteristically green, greenish-gray, and gray, massive, well-cleaved rock of fine to medium grain size.	Twenty-five percent of domestic wells have yields of less than 3 gal/min; supplemental storage may be needed in many wells to meet minimum domestic needs. Water is moderately soft.
	Metarhyolite	Mainly hard, dense, fine-grained rock of purplish color, in part containing isolated crystals of feldspar and quartz.	Same as metabasalt above.
	Greenstone schist	Greenish-gray lustrous phyllite and schist.	Limited areal extent; wells are likely to produce small quantities of soft water.

Table 17. *(Continued)*

System	Geologic unit	Geologic description	Water-bearing characteristics
		READING PRONG SECTION[6]	
Cambrian	Hardyston Formation	Light-gray quartzite and feldspathic sandstone; conglomerate at the base.	Limited data are available; probably yields small to moderate supplies of soft to moderately hard water.
	Metadiabase	Dark-gray, fine-grained intrusives.	Yields small supplies that may be marginally adequate to inadequate for domestic use; many wells require supplemental storage to meet minimum needs. Water is soft and may be corrosive to plumbing.
	Granitic gneiss	Light, medium-grained; predominantly quartz and feldspar.	
	Hornblende gneiss	Dark, medium-grained; includes some rocks that are probably sedimentary in origin.	
	Graphitic gneiss	Dominantly quartz and feldspar; contains varying amounts of graphite.	
		TRIASSIC LOWLAND SECTION[7,9,10,11]	
Triassic	Diabase	Medium- to coarse-grained, dark-gray rock composed mainly of plagioclase feldspar, pyroxene, and accessory magnetite; massive, hard; dark-gray on fresh surface but weathers gray or light buff.	One of the poorest aquifers in the state; yields small supplies of water that are often inadequate for domestic use; about 25 percent of the wells require supplemental storage to meet minimum needs. Water is hard (median hardness is approximately 9 gr/gal) and commonly of poor quality because of shallow circulation system in unit.
	Gettysburg Formation	Composed of five distinct dominant lithologies that are interbedded with one or more of the other lithologies. Quartz conglomerate—fanglomerate made up of poorly sorted pebbles to boulders of white vein quartz and red siltstone in a red silty sandstone matrix; limestone conglomerate—fanglomerate made up of pebbles to boulders of limestone in a matrix of red or gray sandstone or shale; sandstone—fine- to coarse-grained, red, brown, and gray sandstone (includes Heidlers-	Median yield of domestic wells from all lithologies combined is 10 gal/min. Medians for nondomestic wells range from 21 to 185 gal/min; the highest yields are from shale near Middletown and the lowest from quartz conglomerate. Water from quartz conglomerate is soft and low in dissolved solids and tends to be corrosive to plumbing. Water from the rest of the formation is generally of good quality and hard; moderately hard and very hard water are present in some areas.

		burg Member), shale—red and maroon, silty mudstones and shales, containing some very fine grained sandstone interbeds; and shale conglomerate—chips of gray shale in a red sandstone matrix.	
	Hammer Creek Formation	Same lithologies and general descriptions as for Gettysburg Formation with the exception that the Heidlersburg Member is not recognized and no shale conglomerate has been identified in the Hammer Creek Formation.	Median yield of domestic wells from all lithologies combined is 20 gal/min. Medians for nondomestic wells range from 90 to 144 gal/min; the highest yields are from shale and the lowest from sandstone. Water quality is generally good, and the distribution of hardness is similar to that in the Gettysburg.
	New Oxford and Stockton Formations	New Oxford Formation—red mudstone and shale and fine-grained sandstone interbedded with arkosic sandstone; conglomerate and arkosic beds are common in the lower part; Stockton Formation—light-gray, coarse-grained arkosic sandstone; includes reddish-brown mudstone and shale.	Reported yields range from 1 to 330 gal/min, and the median yield is about 12 gal/min; yields of more than moderate amounts (more than 50 gal/min) may be difficult to obtain. Water is generally hard; 16 and 27 percent of the wells produce water exceeding the recommended limits for iron and manganese, respectively (U.S. Environmental Protection Agency, 1975).
Ordovician[12]	Beekmantown Group	Occurs in a small area near York Springs, Adams County. Primarily white or gray marble, some of which is coarsely crystalline and veined with calcite.	Limited data are available; probably a fair to good aquifer that yields moderate to large quantities of very hard water.
		CONESTOGA VALLEY SECTION[13,14,15]	
Ordovician	Cocalico Formation	Bluish-black to dark-gray fissile shale; purple and green shale containing thin quartzite is present near the base.	Reported yields range from 1 to 100 gal/min; about half are less than 20 gal/min. Water is probably moderately hard.
	Hershey, Myerstown, and Annville Formations, undivided	Hershey Formation—dark-gray to black, thin-bedded, argillaceous limestone; Myerstown Formation—medium- to dark-gray, platy, medium-crystalline limestone, carbonaceous at the base; Annville Formation—light-gray, massive, high-calcium limestone.	Limited areal extent; water-bearing properties are unknown.

Table 17. *(Continued)*

System	Geologic unit	Geologic description	Water-bearing characteristics
Ordovician	Ontelaunee Formation	Gray, very finely to finely crystalline, partly laminated dolomite.	Limited areal extent; see section on "Great Valley (east of Susquehanna River)" for probable properties of aquifer.
	Epler Formation	Gray, interbedded limestone and dolomite; abundant white beds in the lower part.	Reported yields range from 1 to 600 gal/min; the median is about 30 gal/min; based on specific-capacity data the Stonehenge is the highest yielding aquifer in the Conestoga Valley sequence. The water is very hard; high levels of nitrate are a common problem.
	Stonehenge Formation	Gray, finely crystalline limestone containing dark-gray silty laminations.	
Ordovician and Cambrian	Conestoga Formation[16]	Gray, fine- to coarse-crystalline limestone; commonly contains laminations that are clayey, graphitic, and micaceous; contains basal beds of carbonate conglomerate.	Maximum reported yield is 250 gal/min; typical sustained yield calculated from specific-capacity data is 20 gal/min; about one in four wells should yield 140 gal/min. Water is very hard; 50 percent of the wells tested in Lancaster County exceeded the recommended limit for nitrate; high dissolved solids are also an occasional problem.
Cambrian	Richland Formation	Gray, interbedded limestone and dolomite; contains beds of fine conglomerate.	Reported yields of six wells range from 2 to 30 gal/min; based on specific-capacity data these rocks are a poor source for public and industrial supplies, but are adequate for domestic use. Water is very hard (median hardness is 16 gr/gal); often contains high concentrations of nitrate and dissolved solids.
	Millbach Formation	White, pinkish-gray, and gray limestone; contains scattered interbeds of dolomite.	
	Buffalo Springs Formation	Gray, argillaceous, silty, and sandy dolomite.	
	Snitz Creek Formation	White to pinkish-gray interbedded limestone and dolomite; has scattered beds of sandstone.	
	Zooks Corner Formation	Gray, very finely crystalline dolomite; commonly silty and sandy; contains some limestone.	Reported yields of five wells range from 3 to 105 gal/min; based on specific-capacity data this unit is a poor source for public and industrial supplies, but is adequate for domestic use. Water is very hard.
	Ledger Formation	Light-gray, coarsely crystalline dolomite.	Reported yields range from 2 to 550 gal/min; the median is 30 gal/min; based on specific-capacity data, this is one of the most productive aquifers in

			wells was estimated to have the potential for producing 400 gal/min in York County. Water is very hard; high concentrations of manganese and nitrate are an occasional problem.
	Kinzers Formation	Gray, rusty-weathering shale and argillaceous to sandy limestone and dolomite.	Limited areal extent; maximum reported yield is 111 gal/min; rated as a poor aquifer for large supplies based on specific-capacity data. Water from the shale is hard and water from the limestone and dolomite is very hard.
	Vintage Formation	Mostly gray, thick-bedded to massive, finely crystalline dolomite; the upper part is primarily pure fine-grained limestone.	Limited areal extent; maximum reported yield is 300 gal/min; only rated as a fair source for large supplies based on specific-capacity data. Water is hard to very hard.
	Antietam Formation	Fine- to medium-grained phyllitic quartzite, in places bluish pink.	Reported yields range from 3 to 40 gal/min, and the median is about 5 gal/min; based on specific-capacity data this is one of the lowest yielding units in the Conestoga Valley section. Water is soft and low in dissolved solids.
	Harpers Formation	Dark-greenish-gray phyllite; contains beds of green and gray quartzite, and some graywacke siltstone and graywacke.	Reported yields range from 1 to 100 gal/min, and the median is 10 gal/min. Water is soft to moderately hard and relatively low in dissolved solids.
	Chickies Formation	Massive, prominently bedded, white vitreous quartzite; in places black shiny slate containing numerous zones of quartzite; a basal quartzose conglomerate is often present.	Reported yields range from 1 to 100 gal/min; about half are less than 6 gal/min. Water is soft and low in dissolved solids; high iron and manganese are an occasional problem.
		PIEDMONT UPLANDS SECTION[13,14,17,18]	
Probably Lower Paleozoic	Peach Bottom Slate and Cardiff Conglomerate, undivided	Peach Bottom Slate—blue-black slate, finely lustrous on cleavage surfaces; Cardiff Conglomerate—greenish-gray quartz conglomerate with muscovite partings.	Limited areal extent; two municipal-supply wells at Delta are pumped at a rate of about 25 gal/min year after year. Water is soft and low in dissolved solids.
	Serpentinite	Dark-green serpentine mottled with light green.	Limited data are available; probably yields small supplies of soft water.
	Peters Creek Schist	Series of light-greenish-gray muscovite, chlorite, and quartz schists interbedded with quartzite.	Reported yields range from 1 to 60 gal/min; about half are 10 gal/min or less. Water is soft and low in dissolved solids; high concentrations of iron are a frequent problem.

Table 17. *(Continued)*

System	Geologic unit	Geologic description	Water-bearing characteristics
Probably Lower Paleozoic	Wissahickon Formation	Includes the following: albite-chlorite schist—coarse- to medium-grained, grayish-blue or green schist; Marburg Schist—bluish-gray to silvery-green, fine-grained schist; Wakefield Marble—blue, thin-bedded crystalline limestone; metavolcanics—green schistose rocks; and oligoclase-mica schist—contains some gneiss and some quartz-rich and feldspar-rich members.	Reported yields range from 2 to 150 gal/min; the median is approximately 10 gal/min. Based on specific-capacity data this unit should be capable of furnishing moderate to relatively large quantities (more than 100 gal/min) of water to wells. Water is soft and low in dissolved solids; high iron and nitrate concentrations are a frequent problem.
Lower Paleozoic to Precambrian	Metamorphic and igneous rocks, undifferentiated	Includes the following: pegmatite; metagabbro; metadiabase; quartz monzonite and quartz-monzonite gneiss; granodiorite and granodiorite gneiss; gabbroic gneiss and gabbro; graphitic gneiss; and granitic gneiss.	Reported yields range from 2 to 70 gal/min; the median is about 10 gal/min. Water is soft and low in dissolved solids.

[1] Becher and Root (1981).
[2] Becher and Taylor (1982).
[3] Carswell and others (1968).
[4] Meisler (1963).
[5] Wood and MacLachlan (1978).
[6] Royer (1983).
[7] Taylor and Royer (1981).
[8] Also occurs in the Pigeon Hills region of Adams and York Counties.
[9] Wood (1980a).
[10] Wood and Johnston (1964).
[11] Johnston (1966).
[12] Physically located in the Triassic Lowland section, but is probably an outlier from the Great Valley section.
[13] Poth (1977).
[14] Lloyd and Growitz (1977).
[15] Meisler and Becher (1971).
[16] Southern part of area.
[17] Poth (1968).
[18] McGreevy and Sloto (1977).

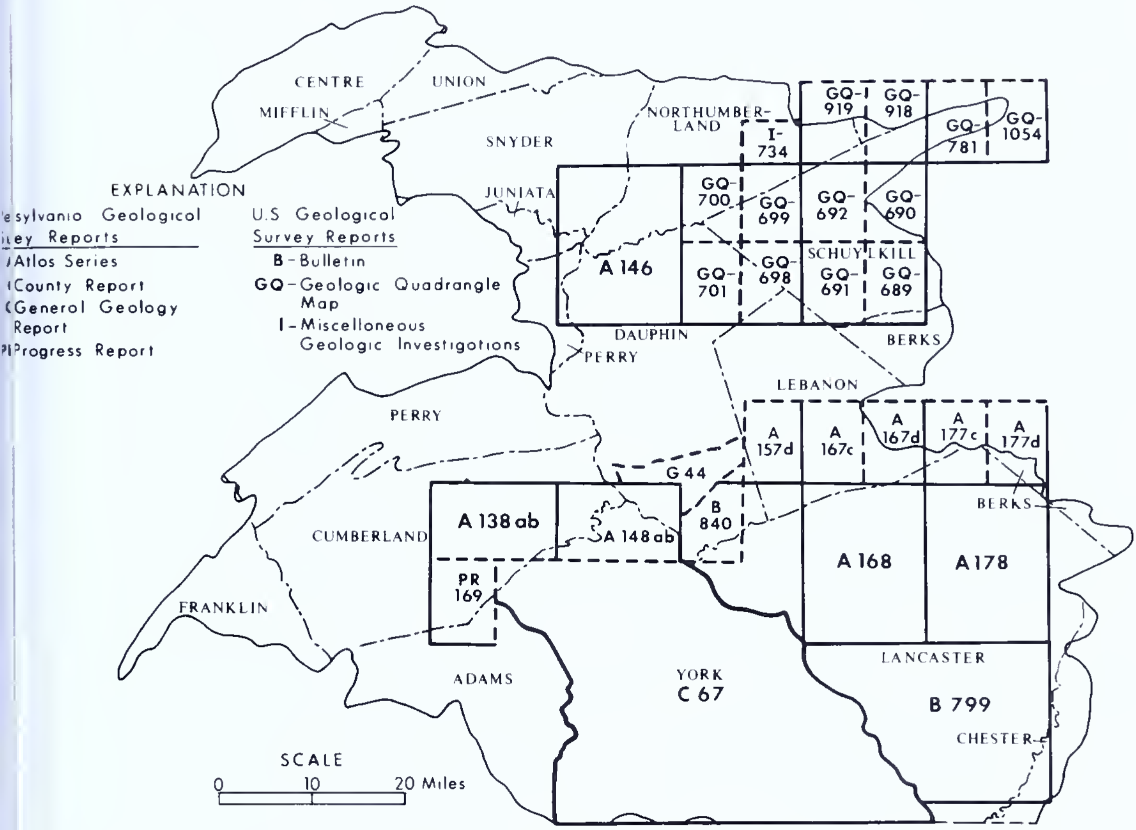

Figure 16. Index of detailed geologic mapping in the Lower Susquehanna River basin.

beds are the most persistent units within the Llewellyn; the intervening strata are characterized by extreme lateral changes in thickness and lithology.

The thickness of this formation is estimated to be about 1,200 to 1,800 feet.

Water-Bearing Properties

Reported yields of 17 wells range from 3 to 100 gal/min. The median yield of 13 domestic wells is 20 gal/min. Four nondomestic wells have a median yield of 29 gal/min. A single well yields less than 5 gal/min and another has a yield greater than 100 gal/min.

Well depths range from 50 to 1,176 feet. Seven of the 17 wells inventoried in this unit have depths less than 100 feet and four had to be drilled deeper than 300 feet. The deepest reported water-bearing zone is at 362 feet.

Water Quality

Four complete chemical analyses by the Department of Environmental Resources (DER) laboratory were used to evaluate the quality of water from

Table 18. *Summary of Well Construction and Yield Data in the Appalachian Mountain Section*

Group formation, or member[1]	Type[2]	Well depth (feet) No. of wells	Well depth Percent[3] 25	Well depth Percent[3] 50 (median)	Well depth Percent[3] 75	Casing length (feet) No. of wells	Casing length Percent[3] 25	Casing length Percent[3] 50 (median)	Casing length Percent[3] 75	Depth to water (feet) No. of wells	Depth to water Percent[3] 25	Depth to water Percent[3] 50 (median)	Depth to water Percent[3] 75	Reported well yield (gal/min) No. of wells	Reported well yield Percent[3] 25	Reported well yield Percent[3] 50 (median)	Reported well yield Percent[3] 75	Specific capacity ((gal/min)/ft) No. of wells	Specific capacity Percent[3] 25	Specific capacity Percent[3] 50 (median)	Specific capacity Percent[3] 75
Llewellyn	D	17	55	101	160	15	41	47	61	9	3	12	32	13	8	20	20	7	.10	.34	.50
Formation	N	5	—	382	—	4	—	62	—	4	—	10	—	4	—	29	—	3	—	.09	—
Mauch Chunk	D	147	103	145	200	136	32	41	50	128	25	35	50	138	8	15	25	83	.10	.18	.36
Formation	N	38	183	300	440	23	29	40	50	26	8	23	54	36	50	70	120	23	.44	.85	1.6
Catskill	D	117	138	160	246	113	40	42	56	102	28	40	60	114	8	14	20	38	.05	.12	.30
Formation[4]	N	26	200	300	335	21	21	38	56	19	20	45	118	26	25	50	78	14	.20	.53	1.5
Sherman Creek	D	51	140	180	265	50	40	42	52	43	35	48	80	50	7	12	20	20	.04	.10	.30
Member of	N	3	—	200	—	3	—	38	—	2	—	41	—	3	—	7	—	2	—	.55	—
Catskill Formation																					
Irish Valley	D	43	143	151	224	42	40	41	58	40	26	35	50	43	9	15	30	12	.07	.17	.40
Member of	N	14	200	283	410	11	19	28	40	12	45	61	135	15	45	55	95	8	.35	1.1	3.5
Catskill Formation																					
Brallier and	D	9	80	166	235	9	24	41	43	9	20	50	75	9	3	5	12	5	.03	.03	.10
Harrell Forma-	N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
tions, undivided																					
Trimmers Rock	D	58	101	155	204	55	38	42	60	46	20	40	62	56	8	12	20	14	.14	.20	1.1
Formation	N	4	—	170	—	4	—	39	—	3	—	10	—	4	—	10	—	2	—	.05	—
Hamilton	D	84	86	125	200	83	24	41	51	68	12	25	20	80	8	15	20	26	.14	.24	.52
Group	N	11	190	260	305	10	23	40	50	10	4	17	49	11	20	75	225	6	.4	3.2	5.6
Onondaga and	D	22	90	122	180	20	37	67	86	17	21	30	48	21	8	12	23	3	—	.5	—
Old Port	N	2	—	130	—	2	—	42	—	2	—	2	—	2	—	42	—	2	—	2.1	—
Formations,																					
undivided																					
Keyser and	D	41	72	125	197	40	28	46	90	37	11	30	52	40	10	15	30	10	.30	.92	2.0
Tonoloway	N	18	140	190	368	16	34	58	83	12	11	31	65	17	24	100	150	4	—	1.8	—
Formations,																					
undivided																					
Wills Creek	D	100	76	104	141	97	37	44	63	92	15	22	43	94	10	15	22	29	.18	.44	1.8
Formation	N	19	85	132	212	17	30	40	56	13	11	32	55	17	15	20	41	10	.46	.69	14

Bloomsburg and Mifflintown Formations, undivided	D	56	79	101	160	53	24	39	45	43	12	22	35	52	8	12	15	15	.19	.22	.68
	N	6	315	415	606	6	37	39	42	6	8	46	60	6	15	26	42	—	—	—	—
Clinton Group	D	17	99	148	235	16	21	33	60	11	10	16	30	16	5	12	19	3	—	.45	—
	N	6	145	174	300	5	—	36	—	3	—	20	—	5	—	20	—	3	—	.67	—
Juniata Formation	D	4	—	210	—	4	—	50	—	1	—	42	—	4	—	11	—	—	—	—	—
	N	3	—	175	—	3	—	30	—	2	—	26	—	3	—	25	—	1	—	.22	—
Reedsville Formation	D	17	68	107	158	17	20	30	48	12	8	20	46	16	7	27	48	3	—	.91	—
	N	5	—	154	—	5	—	31	—	3	—	4	—	5	—	30	—	3	—	.22	—
Coburn Formation through Loysburg Formation, undivided	D	29	110	201	300	29	40	50	100	25	42	90	150	29	6	12	20	7	.02	.04	.17
	N	5	—	201	—	4	—	101	—	5	—	23	—	5	—	50	—	1	—	.62	—

1 Includes only those units for which data were obtained.
2 D, domestic; N, nondomestic.
3 Percentage of wells that have values less than or equal to the value shown.
4 Includes data from the Irish Valley and Sherman Creek Members.

this unit. All of the samples exceed the EPA standard for iron and manganese. One sample exceeds the limit for chloride and another for total dissolved solids. All other measured constituents are below the recommended maximum concentrations.

The results of five field analyses indicate that water from the Llewellyn is moderately soft (median hardness of 5 gr/gal) and contains a low to moderate amount of dissolved solids (median specific conductance of 200 micromhos).

Evaluation of the Aquifer

The water-bearing character of this unit is influenced greatly by mining activity. The quality of water in mine pools and in areas within close proximity to mining operations is usually too poor for most uses. In unmined areas, the Llewellyn yields sufficient quantities for domestic and small industrial or public supplies. High levels of iron and manganese are a persistent problem.

POTTSVILLE GROUP

Stratigraphy

The Pottsville Group consists of gray conglomerate, conglomeratic sandstone, sandstone, siltstone, and some anthracite coal. The Pottsville ranges in thickness from about 275 to more than 800 feet.

Evaluation of the Aquifer

Only limited data were obtained from this unit. However, based on lithological considerations and reports from nearby areas, the Pottsville Group should yield small to moderate amounts of soft to moderately hard water. High iron and manganese are probably a common problem.

MAUCH CHUNK FORMATION

Stratigraphy

The Mauch Chunk Formation consists of interbedded brownish-gray to grayish-red siltstone, claystone, and brownish-gray to pale-red, poorly cemented sandstone. The lower part contains a discontinuous nonred sequence of light-olive-gray mudstone and sandstone.

Estimated thicknesses for this unit range from about 3,700 to 4,500 feet.

Water-Bearing Properties

The distribution of reported well yields is shown in Figure 17. Yields of 176 wells range from 2 to 600 gal/min. The medians from domestic and nondomestic wells are 15 and 70 gal/min, respectively. Eleven (or 8 percent)

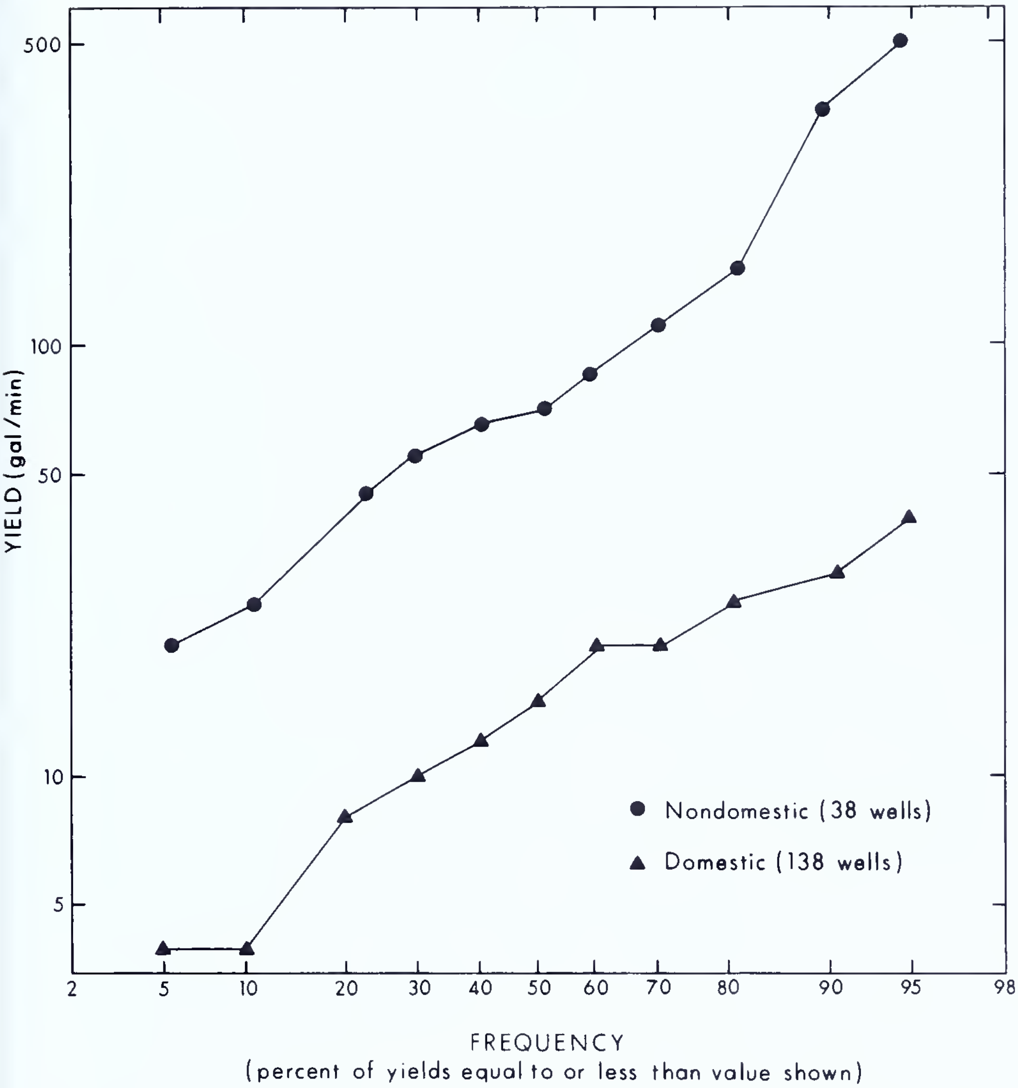

Figure 17. Percent frequency distribution of reported well yields from the Mauch Chunk Formation.

of the wells drilled for domestic use have yields that are less than 5 gal/min, and 13 (or 36 percent) of the nondomestic wells have yields greater than 100 gal/min.

Well depths range from 40 to 961 feet, and the medians are 145 feet for domestic wells and 300 feet for nondomestic wells. Nearly half (18 of 38) of the nondomestic wells were drilled deeper than 300 feet. The deepest reported water-bearing zone is at 552 feet.

Water Quality

Twenty-six complete analyses were used to evaluate the quality of water from this unit. Only two of the samples have iron above the recommended

limit, and a single sample has nitrate above the limit of 10 mg/L as nitrogen. The median concentration of nitrate, however, is highest in the upper part of the basin (3.4 mg/L), which is probably caused by the extensive agricultural activities in the valleys underlain by the Mauch Chunk. Water from this unit is a calcium bicarbonate type, as shown in Figure 18.

The median hardness based on 71 field analyses is 5 gr/gal, and the median specific conductance is 220 micromhos. Thus the water is relatively low in dissolved solids and moderately hard.

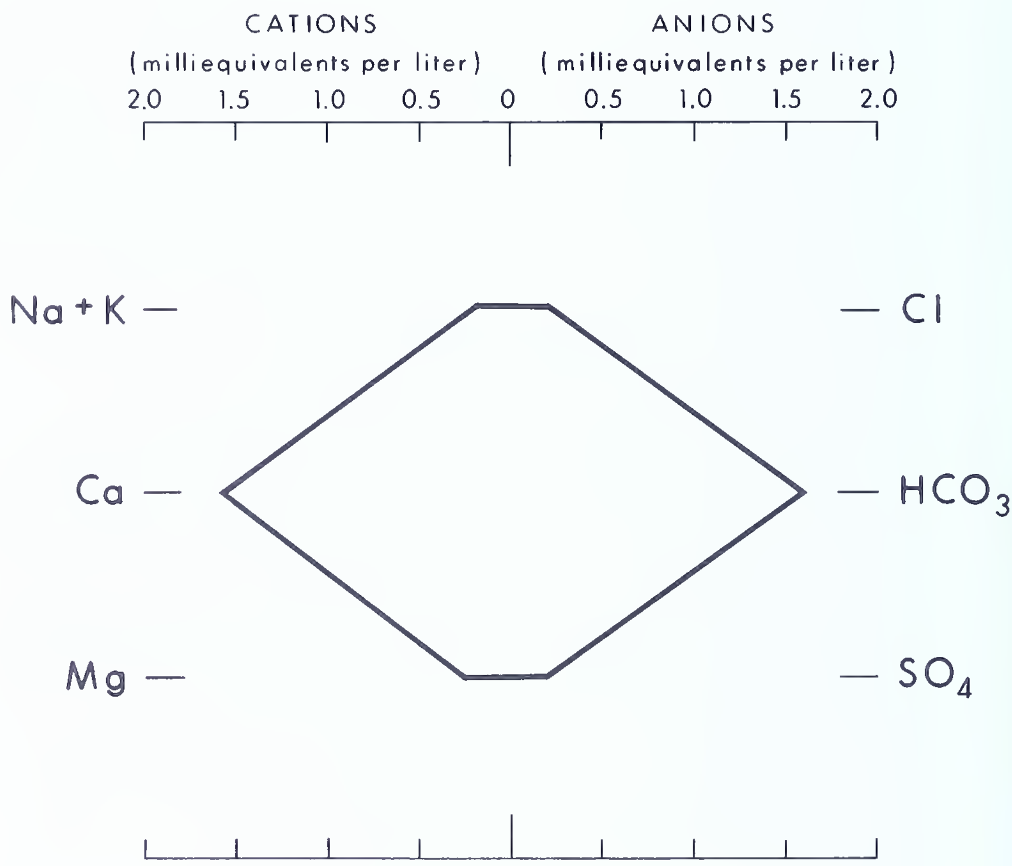

Figure 18. Stiff diagram of the median chemical character of ground-water from the Mauch Chunk Formation (based on 26 analyses).

Evaluation of the Aquifer

The Mauch Chunk Formation will, in general, yield sufficient water of acceptable quality for most uses. Over a third of the wells drilled for high yields produce over 100 gal/min. High levels of nitrate may be a problem in agricultural areas.

POCONO AND SPECHTY KOPF FORMATIONS

Stratigraphy

The Pocono Formation is the principal ridge former in the area and consists of light-gray to medium-dark-gray sandstone and minor siltstone. It is commonly conglomeratic at the base and in the middle.

The Spechty Kopf is primarily composed of light- to olive-gray, cross-bedded sandstone and siltstone. Locally this formation has grayish-red shale near the top and conglomerate in the middle and at the base.

The combined thickness for these units ranges from about 1,100 to more than 1,700 feet.

Evaluation of the Aquifer

These units are unimportant as aquifers because of their high topographic position. Small supplies of soft water may be possible, but some failures to obtain domestic supplies are probable.

CATSKILL FORMATION

Stratigraphy

Nine members of the Catskill Formation have been identified in various parts of the basin, although no more than four are mapped at any single locality. They are the Duncannon, Clarks Ferry, Sherman Creek, Buddys Run, Irish Valley, Long Run, Beaverdam Run, Walcksville, and Towamensing Members.

The Catskill Formation consists of a succession of grayish-red sandstone, siltstone, and shale, and some gray sandstone and conglomerate. The thickness varies from 500 to 9,400 feet in the basin.

Water-Bearing Properties

Sufficient data were available to provide separate statistics for the Sherman Creek and Irish Valley Members in Tables 12, 14, 16, and 18. However, because there is little statistical difference between these members and the rest of the formation, the following discussion is for the undivided Catskill Formation.

Reported yields of 140 wells range from 3 to 200 gal/min. The median yields of domestic and nondomestic wells are 14 and 50 gal/min, respectively. About 5 percent of the wells yield less than 5 gal/min, and four wells were reported to yield 100 gal/min or more.

Figure 19 is a frequency plot of reported well yields from the Catskill Formation. In the upper half of the yield range, nondomestic wells have yields that are consistently three times greater than those drilled for domestic purposes.

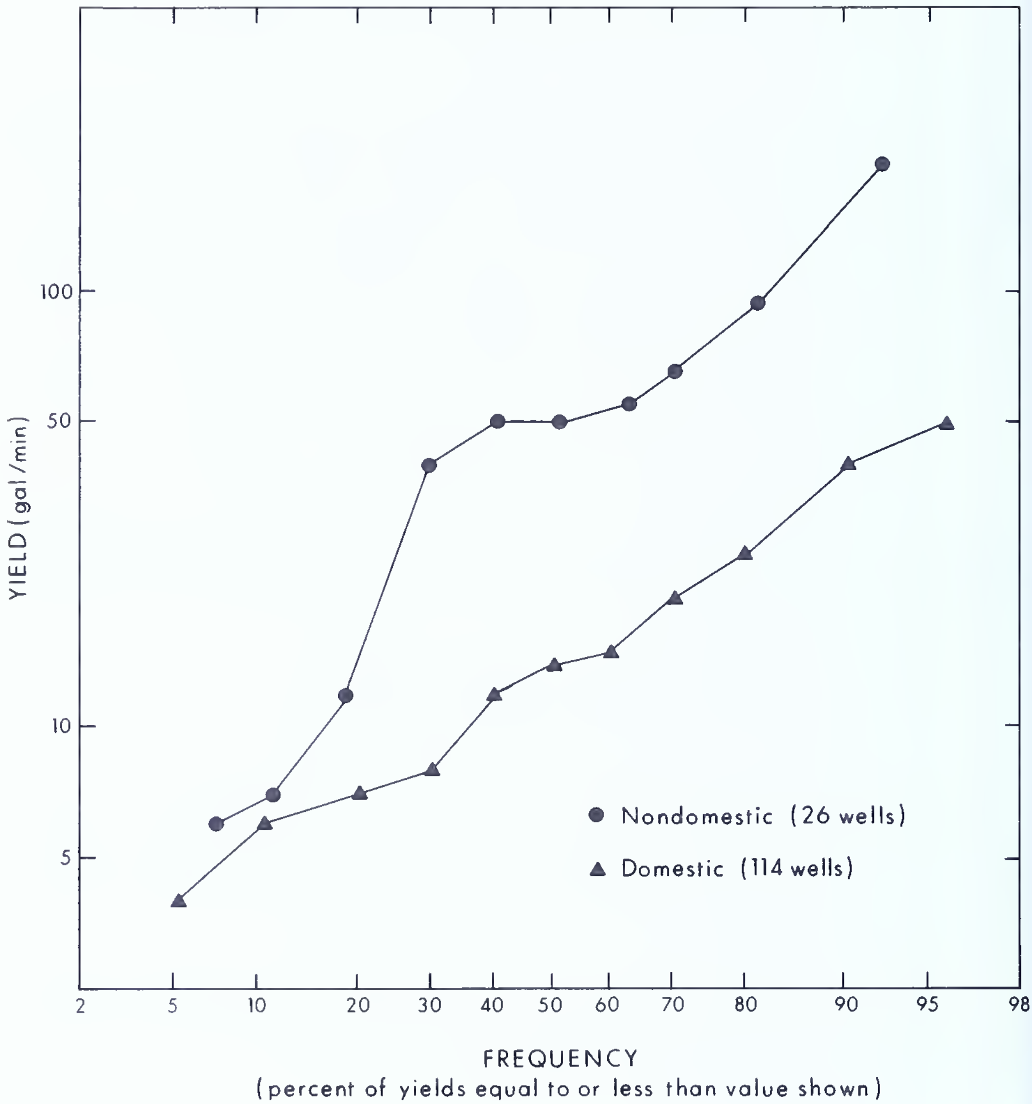

Figure 19. Percent frequency distribution of reported well yields from the Catskill Formation.

Reported depths of 143 wells range from 45 to 595 feet. The median for domestic wells is 160 feet and the median for nondomestic wells is 300 feet. Eleven wells obtained sufficient water at depths of less than 100 feet, and 43 had to be drilled deeper than 300 feet to obtain the desired amount of water. The deepest reported water-bearing zone is at 514 feet.

Water Quality

Thirty-eight complete analyses were used to evaluate the quality of water from this unit. Eleven, or about 29 percent, exceed the EPA recommended

limit for iron and 13, or 34 percent, exceed the limit for manganese. The water is a calcium-magnesium bicarbonate type, as shown in Figure 20.

The median hardness based on 63 field analyses is 3 gr/gal, and the median specific conductance is 155 micromhos. These data indicate that water from the Catskill Formation is soft and comparatively low in dissolved solids.

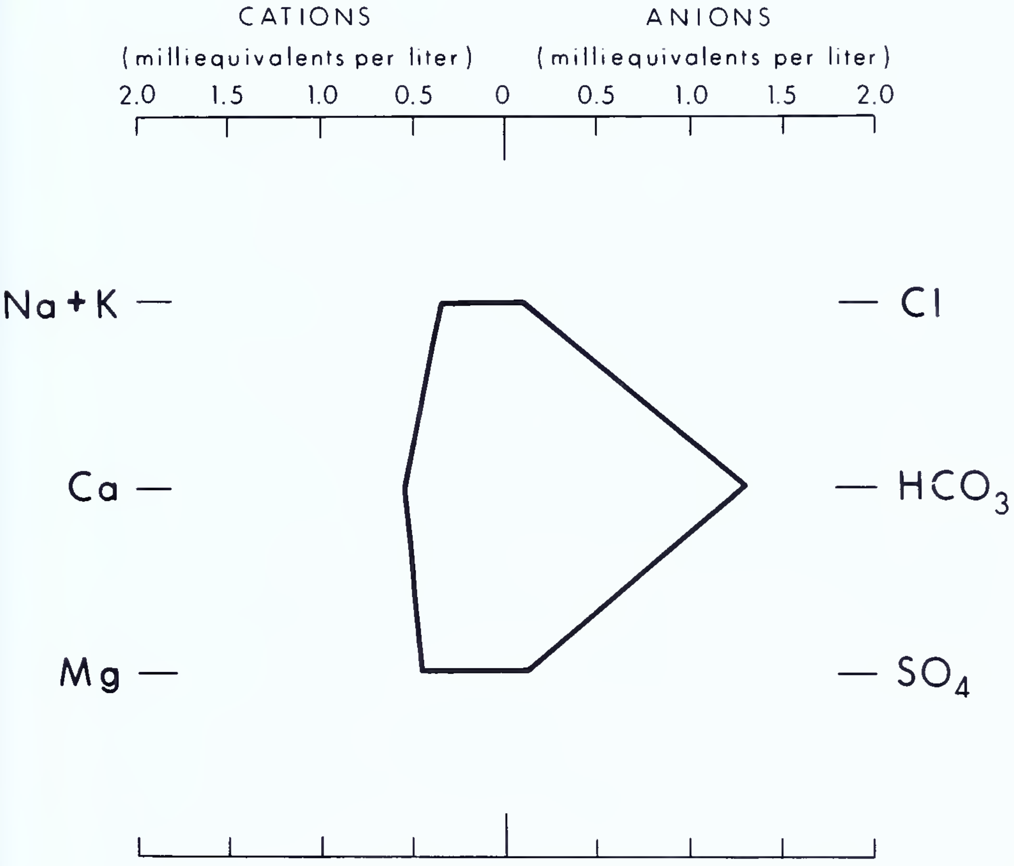

Figure 20. Stiff diagram of the median chemical character of groundwater from the Catskill Formation (based on 38 analyses).

Evaluation of the Aquifer

The Catskill Formation yields water of acceptable quality for domestic and other uses requiring small to moderate supplies. Over a third of the wells produce water that contains high concentrations of iron and manganese.

Only 15 percent of the wells drilled for maximum yield obtained over 100 gal/min. Thus, large yields are generally difficult to obtain. Wells drilled for maximum yield should be at least 300 feet deep and perhaps as deep as 600 feet.

TRIMMERS ROCK FORMATION

Stratigraphy

The Trimmers Rock Formation consists of medium-gray to olive-gray siltstone, shale, and some very fine grained sandstone. A hundred feet of dark-gray to black shale, which in some areas is mapped as the Harrell Formation, occurs at the base.

The Trimmers Rock is about 1,900 to 2,000 feet thick.

Water-Bearing Properties

Reported yields of 60 wells range from 3 to 100 gal/min. The median yield of domestic wells is 12 gal/min. Information was obtained on only four relatively low yielding nondomestic wells, which have a median yield of 10 gal/min. Three, or about 5 percent, of the wells have yields less than 5 gal/min.

Depths of 62 wells range from 50 to 482 feet, and the median is 155 feet

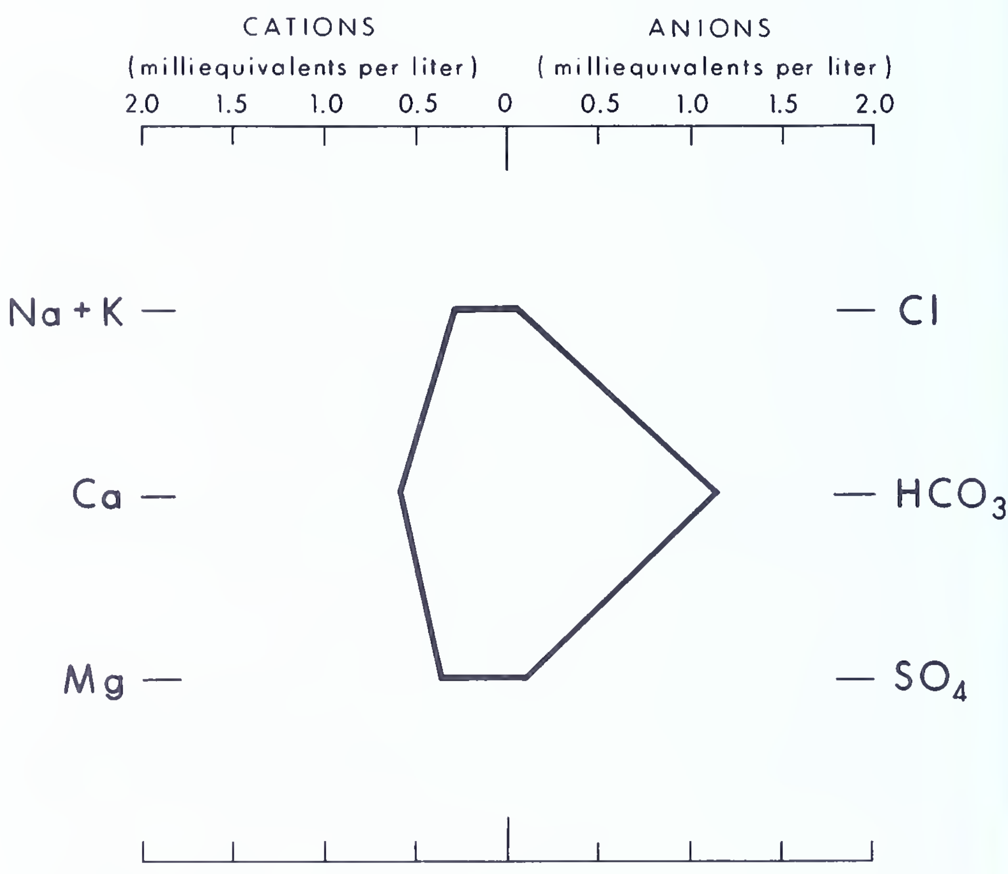

Figure 21. Stiff diagram of the median chemical character of ground-water from the Trimmers Rock Formation (based on 18 analyses).

for domestic wells. Nine wells obtain a sufficient amount of water from depths of less than 100 feet and four are deeper than 300 feet.

The deepest reported water-bearing zone is at 460 feet. Approximately 85 percent of the wells drilled through the 151- to 200-foot depth interval were reported to penetrate at least one water-bearing zone, which makes this the interval having the most abundant quantity of yielding zones.

Water Quality

The quality of water from this formation was evaluated using 18 laboratory analyses. Five exceed the EPA limit for iron and eight exceed the limit for manganese. Two samples have chromium levels that are slightly high. Figure 21 shows that calcium and bicarbonate are the most abundant ions in solution.

The median hardness based on 22 field analyses is 4 gr/gal, and the median specific conductance is 155 micromhos. This indicates that the water is moderately soft and comparatively low in dissolved solids.

Evaluation of the Aquifer

In the Juniata River basin the Trimmers Rock is a poor aquifer (Taylor and others, 1982). In the Lower Susquehanna River basin the rock unit is somewhat better and should yield sufficient supplies for small to moderate needs. Over a third of the wells produce water containing an excessive amount of iron or manganese.

HAMILTON GROUP

Stratigraphy

The Hamilton Group is made up of the Mahantango Formation and the Marcellus Formation. The combined unit ranges in thickness from about 1,800 to 2,100 feet.

Five members of the Mahantango Formation were described by Hoskins (1976) in the Millersburg 15-minute quadrangle. In descending order, the members and lithologies that make up the Mahantango are as follows: Sherman Ridge—olive-gray claystone, siltstone, and some fine-grained sandstone; Montebello—gray, very fine to coarse-grained sandstone and olive-gray siltstone; Fisher Ridge—dark- to medium-gray siltstone and claystone; Dalmatia—gray, very fine to fine-grained sandstone and siltstone; Turkey Ridge—medium-gray, very fine to fine-grained sandstone and minor siltstone. The total thickness ranges between 1,800 and 1,900 feet.

The Marcellus consists of black to dark-gray claystone, medium-gray siltstone, and very fine grained sandstone. Reported thicknesses range between 50 and 240 feet.

Water-Bearing Properties

Reported yields of 91 wells range from 3 to 355 gal/min. Domestic wells have a median yield of 15 gal/min and nondomestic wells have a median of 75 gal/min. The yields of five of the 11 inventoried nondomestic wells exceed 100 gal/min.

The depths of 95 wells range from 42 to 500 feet. Domestic wells have a median depth of 125 feet; 28 are less than 100 feet deep and five are less than 300 feet. The median depth of nondomestic wells is 260 feet, and four of the 11 wells are deeper than 300 feet.

Yielding-zone data were obtained on 91 wells. The deepest reported zone is at 396 feet, and the depth range in which zones are most frequently reported is 51 to 100 feet (over 90 percent of the wells have water-bearing zones in that interval).

Water Quality

Twenty-three laboratory analyses were used to evaluate the quality of water from this unit. The EPA recommended limit for iron and manganese is exceeded in nine and 16 samples, respectively. All other constituents are within drinking water standards.

Thirty-nine field analyses indicate that the water is moderately hard (median of 4 gr/gal) and contains a low to moderate amount of dissolved solids (median specific conductance of 185 micromhos).

Evaluation of the Aquifer

The Hamilton Group yields sufficient water of acceptable quality for small to moderate supplies. Over two thirds of the wells produce water containing objectionable amounts of iron and manganese, and many produce water containing hydrogen sulfide, especially from the Marcellus Formation.

Large supplies can be developed from parts of this unit, as indicated by the fact that nearly half of the wells drilled for nondomestic purposes yield over 100 gal/min.

ONONDAGA AND OLD PORT FORMATIONS

Stratigraphy

The Onondaga Formation consists of shaly limestone interbedded with calcareous shale, and noncalcareous shale. The maximum thickness is about 120 feet.

The Old Port Formation is composed of a sequence of gray chert, siltstone, claystone, medium- to coarse-grained sandstone, and shaly limestone. The thickness reaches a maximum of about 150 feet.

Water-Bearing Properties

Reported yields of 23 wells range between 4 and 60 gal/min. The median for domestic wells is 12 gal/min. Two nondomestic wells average 38 gal/min.

The depths of 24 wells range from 35 to 500 feet, and the median is 122 feet. The deepest reported water-bearing zone is at 460 feet.

Water Quality

The analysis of the single sample collected from these units shows all constituents to be within drinking water standards.

Results of 10 field analyses indicate that the water is hard (median of 7 gr/gal) and contains a moderate amount of dissolved solids (median specific conductance of 285 micromhos).

Evaluation of the Aquifer

This unit is too thin to be of importance as an aquifer in parts of the basin. In areas where a sufficient thickness is present, these formations yield small to moderate amounts of hard water to wells.

In the Juniata River basin, 25 percent of the wells drilled for nondomestic use in these formations have yields of 150 gal/min or more (Taylor and others, 1982). Although data are not available to confirm the availability of large supplies in the Lower Susquehanna River basin, this information from an adjacent basin suggests that larger yields should be possible.

KEYSER AND TONOLOWAY FORMATIONS

Stratigraphy

The Keyser Formation is between 100 and 200 feet thick and consists of gray limestone, argillaceous limestone, and claystone. The lower part is nodular and very fossiliferous.

The Tonoloway Formation is composed of dark- to medium-gray laminated limestone and argillaceous limestone. Reported thicknesses range from a little more than 100 feet to over 600 feet.

Water-Bearing Properties

Reported yields of 57 wells range from 1 to 410 gal/min. The median yields of domestic and nondomestic wells are 15 and 100 gal/min, respectively. Nine of the 17 wells drilled for nondomestic purposes produce 100 gal/min or more. Three wells have yields of less than 5 gal/min.

Well depths range from 40 to 503 feet. Seventeen of the 41 domestic wells are less than 100 feet deep and two are greater than 300 feet deep. One third

of the nondomestic wells are deeper than 300 feet. The medians are 125 and 190 feet for domestic and nondomestic wells, in that order.

Water-bearing zones are common to a depth of 250 feet, and the deepest reported zone occurs at 470 feet.

Water Quality

Seven complete analyses were used to evaluate the water quality. The following constituents are present in concentrations equaling or exceeding the recommended limit in single samples: iron, chromium, nitrate, and dissolved solids.

The median hardness based on 20 field analyses is 12 gr/gal, which is considered to be very hard. The water is moderately high in dissolved solids, as indicated by the median specific conductance of 430 micromhos.

Evaluation of the Aquifer

Figure 22 shows the distribution of nondomestic well yields from the Keyser and Tonoloway Formations and the underlying Wills Creek Formation. The Keyser and Tonoloway stratigraphic interval represents one of the best aquifers in the Valley and Ridge province. Sufficient quantities of water can be developed for most uses, and some very large yields are possible.

Water from these units is very hard and moderately high in dissolved solids and will require treatment for many uses. High sulfates are reported to be a problem in some localities.

WILLS CREEK FORMATION

Stratigraphy

The Wills Creek Formation consists of interbedded olive- and greenish-gray, calcareous and noncalcareous shale and argillaceous limestone. There are a few interbeds of grayish-red shale and gray, fine-grained sandstone.

The thickness approaches 600 feet throughout much of the basin.

Water-Bearing Properties

The median reported yield of 94 domestic wells is 15 gal/min. Seventeen nondomestic wells have a median yield of 20 gal/min. Yields range from 1 to 160 gal/min. Only four wells have yields less than 5 gal/min and two have yields greater than 100 gal/min.

Depths of 119 wells range from 18 to 604 feet. The median depths for domestic and nondomestic wells are 104 and 132 feet, respectively. Fifty wells, or 42 percent, are less than 100 feet deep and three had to be drilled deeper than 300 feet to obtain the desired yield.

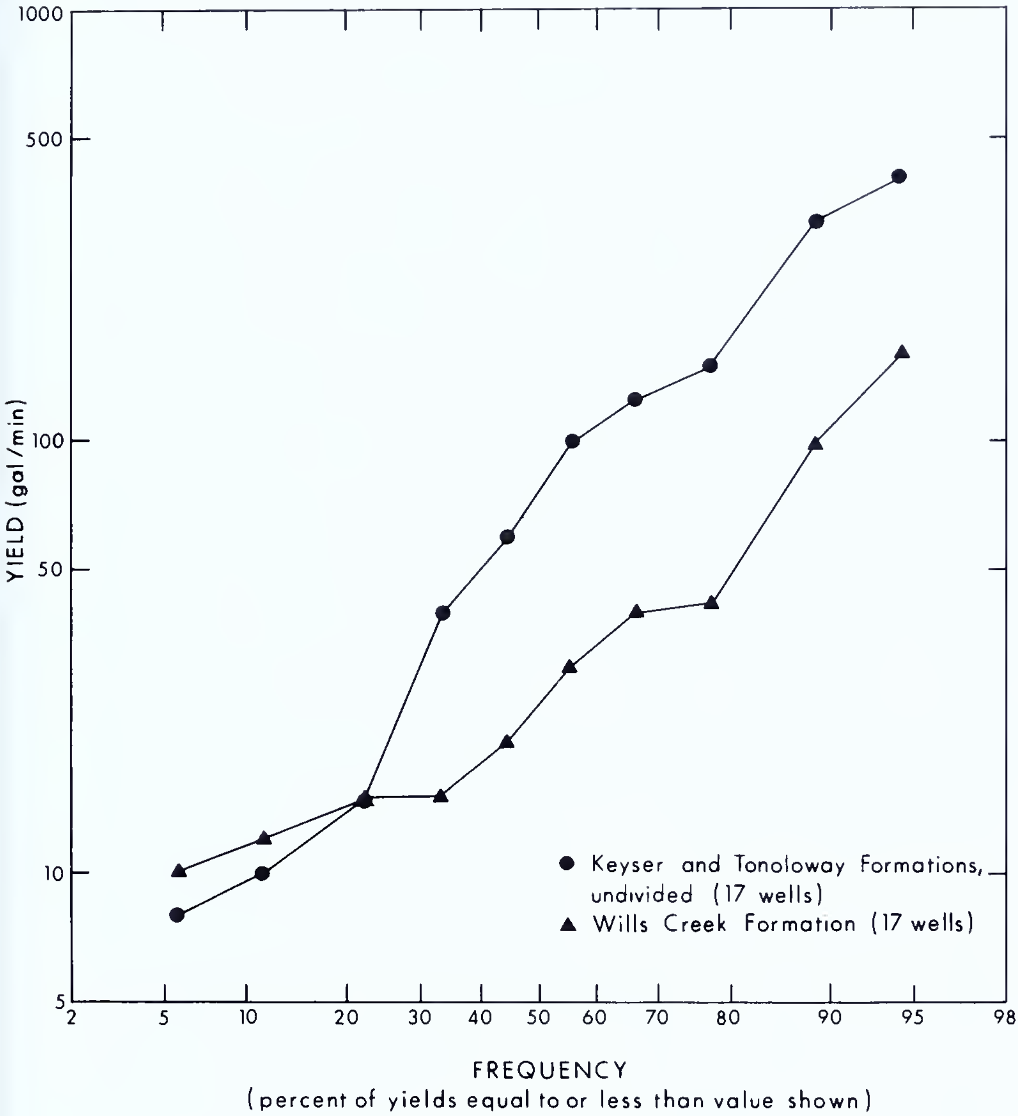

Figure 22. Percent frequency distribution of nondomestic well yields from the Keyser and Tonoloway Formations, undivided, and the Wills Creek Formation.

The deepest reported yielding zone is at 261 feet. Every well that penetrates the 50- to 100-foot and the 101- to 150-foot depth intervals has at least one reported zone per interval.

Water Quality

Eight complete analyses were used to evaluate the groundwater quality. A single sample has an iron concentration in excess of the recommended limit. All other measured constituents are within EPA drinking water standards.

The median hardness based on 48 field analyses is 11 gr/gal, and the median specific conductance is 420 micromhos. These data indicate that the water is very hard and moderately high in dissolved solids.

Evaluation of the Aquifer

The Wills Creek Formation yields sufficient groundwater of acceptable quality for small to moderate supplies, and some larger supplies should be possible. The large proportion of shallow wells and shallow yielding zones indicates that the cost of developing a water supply should be comparatively low.

The water is hard to very hard and requires treatment for some uses.

BLOOMSBURG AND MIFFLINTOWN FORMATIONS

Stratigraphy

The Bloomsburg Formation is predominantly grayish-red shale and mudstone with some interbeds of light-gray, very fine grained sandstone. A few limestone beds may also be present. The thickness is approximately 450 feet.

The underlying Mifflintown Formation consists of dark-gray calcareous shale and interbedded medium- to dark-gray limestone. The thickness is generally between 170 and 200 feet.

Water-Bearing Properties

Reported yields of 58 wells range from 2 to 100 gal/min. The median for domestic wells is 12 gal/min, and three wells have yields of less than 5 gal/min. Data were only obtained for six nondomestic wells, which have a median yield of 26 gal/min.

Well depths range from 50 to 870 feet, and the median depths are 101 and 415 feet for domestic and nondomestic wells, respectively. The deepest reported water-bearing zone is at 606 feet.

Water Quality

Four complete analyses were used to evaluate the quality of water from these formations. Iron and manganese are present in concentrations exceeding the EPA recommended limit in two samples each.

The median hardness based on 33 field analyses is 5 gr/gal, and the median specific conductance is 215 micromhos. This indicates that the water is moderately hard and comparatively low in dissolved solids.

Evaluation of the Aquifer

These rocks generally yield sufficient groundwater for small to moderate supplies. About 45 percent of the wells obtain an adequate amount of water for domestic use from depths of 100 feet or less, which suggests an abun-

dance of shallow yielding zones. This, coupled with the ease of drilling in predominantly shale formations, should result in a relatively low cost for development of small water supplies in these formations. The high median depth of the nondomestic wells (five of the six wells inventoried are greater than 300 feet deep) suggests that large supplies are difficult to obtain.

CLINTON GROUP

Stratigraphy

Two formations make up the Clinton Group: the Keefer Formation and the underlying Rose Hill Formation. The Keefer Formation is primarily light- to dark-gray, hematitic sandstone containing interbeds of dark-gray shale and limestone. It is about 38 feet thick.

The Rose Hill Formation is light-olive-gray to brownish-gray shale containing some minor interbedded siltstone and sandstone. Layers of coarse-grained hematitic sandstone, which are grayish red to reddish black, are generally present in the medial part. Reported thicknesses for the Clinton Group range from about 575 to 950 feet.

Water-Bearing Properties

Reported yields of 21 wells range from 2 to 180 gal/min. The median for domestic wells is 12 gal/min. Well depths range from 50 to 390 feet, and the median is 148 feet for domestic wells. The deepest reported water-bearing zone is at 363 feet.

Water Quality

All constituents are within drinking water standards in the two samples collected for complete analysis. The median hardness based on seven field analyses is 4 gr/gal, and the median specific conductance is 250 micromhos. These data indicate that the water is soft to moderately hard and contains a moderate amount of dissolved solids.

Evaluation of the Aquifer

The Clinton Group yields sufficient water of acceptable quality for small and some moderate supplies. Large supplies of over 100 gal/min are difficult to obtain because of the lithologic character (predominantly shale) of the unit, and because it occurs under steep slopes and relatively high topographic positions.

TUSCARORA, JUNIATA, AND BALD EAGLE FORMATIONS

Stratigraphy

The Tuscarora, Juniata, and Bald Eagle Formations are prominent ridge and upland bench formers throughout much of the basin.

The Tuscarora Formation primarily consists of light- to medium-gray sandstone and minor quartzite, containing interbedded shale. It is about 400 to 700 feet thick.

The Juniata Formation consists of brownish- to grayish-red sandstone, some siltstone, and shale and is approximately 1,100 feet thick.

The Bald Eagle Formation is composed of 600 to 900 feet of gray to olive-gray and grayish-red, fine- to coarse-grained sandstone and some conglomerate.

Evaluation of the Aquifers

Because these units generally underlie wooded ridges, there has been little attempt to develop groundwater supplies from them. Only seven wells from these units were inventoried, and only one sample was collected for complete chemical analysis. Based on this limited information and lithologic and topographic considerations, these units should provide small supplies of soft groundwater.

REEDSVILLE FORMATION

Stratigraphy

The Reedsville Formation consists of medium-gray, thin- to medium-bedded silty shale and shaly siltstone. There are a few interbeds of very fine grained sandstone. The formation is approximately 1,000 feet thick.

Water-Bearing Properties

Reported yields of 16 domestic wells range from 4 to 70 gal/min, and the median is 27 gal/min. The maximum yield from five nondomestic wells is 180 gal/min, and the median is 30 gal/min.

Well depths range from 45 to 350 feet, and the median for all wells is about 120 feet. The deepest reported yielding zone is at 345 feet.

Water Quality

The two samples that were collected from this unit have all constituents within recommended limits. The results of seven field analyses indicate that the water is hard (7 gr/gal) and contains a moderate amount of dissolved solids (320 micromhos).

Evaluation of the Aquifer

The Reedsville Formation generally yields sufficient quantities of water of acceptable quality for small to moderate supplies. Excessive iron and manganese are a problem in some areas (Taylor and others, 1982), and the water occasionally contains objectionable amounts of hydrogen sulfide.

COBURN FORMATION THROUGH LOYSBURG FORMATION

Stratigraphy

The interval from the Coburn Formation through the Loysburg Formation is a sequence of Middle to Upper Ordovician carbonate rocks approximately 1,000 to 1,200 feet thick. In descending order, the formations and lithologies that make up this stratigraphic section are as follows: Coburn Formation—medium-gray limestone; Salona Formation—very dark gray to black shaly limestone and calcareous shale; Nealmont Formation—medium-gray fossiliferous limestone; Benner Formation—light- to dark-gray, thick-bedded limestone; Snyder Formation—light- to medium-gray limestone; Hatter Formation—medium-gray argillaceous limestone; and Loysburg Formation—light- to medium-gray, medium-bedded limestone overlying laminated, alternating beds of limestone, dolomitic limestone, and dolomite.

Water-Bearing Properties

Reported yields of 34 wells range from 1 to 400 gal/min. The medians are 12 and 50 gal/min for domestic and nondomestic wells, respectively. Six of the 29 domestic wells, or about 21 percent, have yields less than 5 gal/min.

Well depths range from 45 to 350 feet, and the median is 201 feet for both domestic and nondomestic wells. The deepest reported water-bearing zone is at 320 feet.

Water Quality

Four samples were collected from these formations for complete analysis. Other than a single sample which has excessive manganese, all constituents are within drinking water standards. Nine field analyses indicate that the water is very hard (16 gr/gal) and high in dissolved solids (specific conductance is 515 micromhos).

Evaluation of the Aquifer

Insufficient data are available to evaluate the maximum potential of these units. However, a single well has a reported yield of 400 gal/min, which suggests that large yields are possible. Data from domestic wells indicate that small to moderate supplies of very hard water can be developed, but that about one in five wells will yield less than 5 gal/min.

BELLEFONTE AND AXEMANN FORMATIONS

Stratigraphy

The Bellefonte Formation is primarily medium- to thick-bedded, gray dolomite containing minor amounts of chert and sandstone. The thickness of this unit averages about 1,000 feet.

The underlying Axemann Formation is mainly limestone but contains a few thin layers of dolomite; it ranges between 50 and 200 feet in thickness.

Evaluation of the Aquifer

Because of their limited areal extent, too few data were obtained from these formations to evaluate them. In the Juniata River basin (Taylor and others, 1982), the data indicate that comparatively large supplies are obtainable from these formations, and that there should be few failures when attempting to obtain domestic supplies. The water is very hard and high in dissolved solids and requires treatment for some uses.

MANAGEMENT OF WATER SUPPLIES

GROUNDWATER–QUANTITY MANAGEMENT

Only a fraction of the total available groundwater is presently being used in the Lower Susquehanna River basin. Based on the analysis of annual streamflow, a groundwater recharge of between 160 and 330 (gal/min)/mi^2 can be expected about 90 percent of the time. If only 25 percent of this recharge (a conservative amount) was developed by widely spaced wells, 330 to 670 Mgal/d could be obtained without seriously affecting groundwater levels or reducing streamflow. This is roughly three to six times the estimated groundwater use in the basin in 1970.

There are, however, a few areas where water use is sufficiently intense and insufficient water supplies have been developed to preclude water shortages during moderate droughts. For example, in the 1980–81 drought, which encompassed much of eastern Pennsylvania, 23 water companies in the Lower Susquehanna River basin had to place use restrictions on their supply because of water shortages. Although there was ample recharge to the groundwater system to meet the demand, the shortages occurred because the companies had not developed sufficient excess capacity to withstand a drought of this intensity.

Most groundwater-quantity problems may be alleviated either by increasing the number of wells in order to spread pumpage over a larger area, by periodically utilizing another source of supply to allow water levels to recover, or by reducing the demand on the water system through water conservation efforts.

The Susquehanna River Basin Commission has enabling legislation which allows them to regulate some groundwater withdrawals. In September 1976 the Commission adopted a regulation requiring compensation for certain consumptive water uses during low-streamflow periods. The purposes of the regulation are protection of public health, stream-quality control, economic development, protection of fisheries, recreation, dilution and

abatement of pollution, the prevention of undue salinity, and protection of the Chesapeake Bay.

Withdrawals from surface or groundwater of 100,000 gal/d or more, from which more than 20,000 gallons are used consumptively, are covered by this regulation.

In addition, in the fall of 1978 the Commission adopted a policy on water conservation which sets forth project review criteria from which the Commission will evaluate any new or requested increase for the withdrawal of water from a surface or groundwater resource for public water-supply utilities, industries, and irrigational usage.

GROUNDWATER–QUALITY MANAGEMENT

The natural quality of groundwater in the basin is generally acceptable for most uses. Some aquifers, or zones within aquifers, contain poor-quality water that is somewhat isolated from the better quality groundwater. Wells should be constructed in such a fashion as to maintain this isolation and thus not allow poor-quality water to migrate into aquifers containing water of usable quality.

Most man-induced water-quality problems are primarily local in extent and can be minimized by constructing wells so that surface water cannot enter them. Such factors as adequate length, thickness, and type of casing in conjunction with adequate formation sealing material (usually cement grout) must be considered when constructing a well.

Point sources of groundwater contamination (hydrocarbon spills, malfunctioning septic tanks, etc.) must be identified and eliminated and their effects minimized through cleanup operations.

Nitrate contamination of groundwater as a result of heavy fertilization of croplands appears to be a problem in areas underlain by carbonate rocks and in the Piedmont Uplands section. Agricultural practices that will minimize this problem need to be pursued.

CONCLUSIONS

Groundwater use in the Lower Susquehanna River basin was about 127 Mgal/d in 1970. State Water Plan projections are for a 13 percent per decade increase in water use from 1970 to 1990, and most of the increase will come from groundwater (Pennsylvania Department of Environmental Resources, 1980a, b).

The basin has abundant water resources resulting from an average of approximately 40 inches of precipitation. Streamflow accounts for about 45 percent of annual precipitation, or about 18 inches. Groundwater flow averages about 56 percent of streamflow. About 55 percent of precipitation (22 inches) is lost annually to evapotranspiration.

Mean recharge to the groundwater system ranges between 215 and 520 (gal/min)/mi^2. The lowest values are for the metamorphic rocks in eastern Lancaster and western Chester Counties. The highest recharge is to the carbonate rocks of the eastern Great Valley.

Lithology, topography, and geologic structure influence the depth, size, and abundance of water-bearing zones and, thus, well yields. Rocks that consist primarily of limestone or dolomite have the highest well yields, followed by sandstone and shale in that order. Yields of valley wells are two to three times higher than yields of wells located in other topographic settings. Geologic structures that have an important influence on well yields are faults, folds, fractures, and bedrock dip.

Groundwater quality is generally adequate for most uses. Major differences in chemistry occur between water from primarily calcareous rock units and water from noncalcareous units.

Iron and manganese are the natural constituents in groundwater that most commonly exceed EPA recommended limits; more than 28 percent of the analyzed samples have excessive amounts of one or both of these constituents.

Major types and sources of groundwater contamination are bacterial organisms and nitrates from sewage, acid mine drainage, excessive nitrates from improper agricultural practices, petroleum products from buried storage tanks, chlorinated solvents from degreasing operations, and leachate from landfills.

SOURCES OF INFORMATION ABOUT WATER

A variety of information on water supplies is available from the government agencies listed below. When requesting information it is important to give an accurate location of the site for which information is desired.

The Bureau of Topographic and Geologic Survey, Department of Environmental Resources, has information on the geology of the basin and has published reports that contain detailed descriptions of the rocks that underlie the area and their hydrologic properties. Well drillers' logs and reports on new wells that have been drilled are also available.

The Bureau of Community Environmental Control, Department of Environmental Resources, can supply information on well construction requirements for public and semipublic water supplies, biological reports on well water, and information on the chemical quality of groundwater. The bureau, through various regional offices, tests water samples for bacterial pollution, and also can advise on effective corrective measures when pollution is reported.

The Division of State Water Plan, Bureau of Water Resources Management, Pennsylvania Department of Environmental Resources, has informa-

tion on water use, stream discharges, flood data, reservoir requirements, and power plant discharges.

The Pennsylvania Public Utility Commission, Bureau of Rates and Research, has information on some municipal water supplies, including source, average daily use, total annual use, and estimated future needs.

The U.S. Geological Survey, Federal Building, Harrisburg, has data on wells, springs, and streams and on the chemical quality of water.

Local well drillers and pump installers can provide prices and suggest the type of equipment needed to develop a water supply. They can also suggest the proper well diameter for the necessary pumping equipment. Pump installers can supply information concerning the size of the pump, depth of the pump setting, and the pressure-tank capacity.

If the chemical analysis of the well water indicates that treatment is necessary, commercial water-treatment companies can provide the necessary information and equipment.

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GLOSSARY

Aquifer. A formation that yields significant quantities of water to wells and springs.

Baseflow. Discharge entering stream channels as flow from the groundwater reservoir; the fair-weather flow of streams.

Carbonate rocks. Rocks composed dominantly of the carbonate minerals calcite and dolomite. Limestone and dolomite are the most common rocks of this type.

Clastic. Consisting of fragments of rocks that have been moved individually from their place of origin.

Dip of beds. The angle at which the formation or bed is inclined from the horizontal, measured at a right angle to the strike or trend of the formation or bed.

Discharge, groundwater. The process by which water is removed from the saturated zone; also the quantity of water removed.

Drawdown. The lowering of the water level in a well, caused by pumping.

Evapotranspiration. Water removed from a land area by direct evaporation from water surfaces and moist soil, and by plant transpiration.

Fault. A fracture or fracture zone along which there has been displacement of the two sides relative to each other. The displacement may range from a few inches to many miles.

Formation. A fundamental unit in rock-stratigraphic classification. It is a body of rock characterized by uniform rock type; it is prevailingly tabular and is mappable at the earth's surface or traceable in the subsurface.

Fracture. A break in the rock.

Groundwater reservoir. An aquifer or a group of related aquifers underlying a given area.

Group. A sequence of rocks consisting of two or more formations.

Hardness. A chemical property of water, caused mostly by the presence of calcium and magnesium, which increases the amount of soap needed to produce a lather. Water that has a hardness, calculated as grains of calcium carbonate per gallon, less than 3.5 is soft; between 3.5 and 7.0 is moderately hard; between 7.0 and 10.5 is hard; and greater than 10.5 is very hard. Values may be converted to milligrams per liter by multiplying by 17. Hardness values used in this report were determined in the field by use of a Calgon Speedy kit for testing water hardness. (Use of a brand name is for identification purposes only and does not imply endorsement by the Pennsylvania Geological Survey).

Hydrogeologic unit. A formation, part of a formation, or a group of formations in which there are similar hydrologic characteristics.

Igneous rock. A rock that solidified from molten material.

Metamorphic rock. A rock derived from preexisting rocks by change in mineral composition or texture caused by heat and/or pressure.

Paleozoic Era. A span of geologic time that is between the Late Precambrian and Mesozoic Eras.

Permeability. The capacity of a material to transmit a fluid.

pH. The negative logarithm of the hydrogen-ion concentration. A pH of 7.0 indicates neutrality of a solution. Values higher than 7.0 denote alkaline solutions; values lower than 7.0 indicate acidic solutions.

Physiographic province. A region of generally uniform topography usually related to uniform subsurface geologic structures.

Porosity. The ratio of the volume of openings in a rock to its total volume, expressed as a percentage.

Primary openings. Openings or voids existing when the rock was formed. In sedimentary rocks, openings result from the shape and nature of the original sediment and the way the particles are fitted together.

Recharge, groundwater. The process by which water is added to the saturated zone; also the quantity of water added.

Runoff. That part of the precipitation that appears in streams. It is the same as streamflow unaffected by diversions, dams, or other works of man.

Saturated zone. The zone in which interconnected openings are saturated with water.

Secondary openings. Voids produced in rocks by solution, weathering, or breaks in the rock subsequent to the original formation of the rock.

Specific capacity. The pumping rate of a well, in gallons per minute, divided by the drawdown of the water level in the well, in feet.

Specific conductance. A measure of the capacity of water to conduct an electrical current. It varies with concentration and degree of ionization of the constituents.

Stream-gaging station. A gaging station where a record of discharge of a stream is obtained. Within the U.S. Geological Survey this term is used only for those gaging stations where a continuous record of discharge is obtained.

Surface water. Water on the surface of the earth.

Transpiration. The process by which vapor escapes from the living plant, principally the leaves, and enters the atmosphere.

Water table. The upper surface of the zone of saturation, which is the zone in which openings in permeable rocks are filled with water.

TABLE 19. CHEMICAL ANALYSES OF GROUNDWATER

Well number	Date of collection	pH	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO4)	Zinc (Zn)
APPALACHIAN MOUNTAIN SECTION LLEWELLYN FORMATION																								
Sc- 417	5/6/81	7.0	.001	.10	110	<.001	29	3.0	<.01	140	.1	100	.7	.001	.18	6.1	<.01	.12	<.01	.02	.3	4.3	5	.15
418	5/6/81	6.9	.001	.03	110	<.001	30	3.0	<.01	138	.2	100	1.5	<.001	.14	5.9	<.01	.20	<.01	.02	.3	2.9	<5	.03
438	4/16/81	6.5	.001	.07	110	<.001	23	5.0	.02	126	.1	98	1.2	.003	.14	7.6	<.01	.31	<.01	.02	.4	10	<5	.02
458	5/13/81	5.9	.001	.06	22	<.001	59	330	<.01	846	<.1	270	.78	.037	.44	15	<.01	.03	<.01	.72	1.0	110	11	.40
MAUCH CHUNK FORMATION																								
Da- 621	5/27/81	6.7	.001	.06	80	<.001	28	2.0	.01	112	<.1	66	.05	.002	.01	1.4	.01	.01	<.01	.16	<10	<10	<5	.03
626	4/15/81	6.3	.001	.06	76	<.001	28	6.0	.01	138	.3	94	2.0	.002	<.01	2.7	.01	.01	<.01	2.80	.3	2.2	25	.09
627	4/15/81	6.4	.001	.05	110	<.001	45	18	.01	174	.2	130	.13	.001	<.01	1.8	<.01	.01	<.01	.62	.4	5.5	10	.31
629	4/15/81	6.4	.001	.02	68	<.001	29	7.0	<.01	120	.2	86	.05	.002	.02	2.1	.03	.01	<.01	2.40	.3	2.9	10	.03
644	4/30/81	7.1	.004	.03	38	<.001	41	8.0	<.01	170	.1	120	<.01	.001	<.01	4.8	<.01	.06	<.01	3.30	.5	5.7	25	.03
652	5/5/81	7.1	.003	.03	110	<.001	42	6.0	.02	192	.2	96	.02	.001	.01	4.2	.02	.01	<.01	7.70	.5	7.3	15	.01
653	5/6/81	7.1	.003	.01	100	<.001	32	3.0	<.01	132	.1	76	.05	.001	.01	3.4	.01	.01	<.01	2.60	.4	6.0	5	.02
656	5/6/81	7.3	.005	.03	98	<.001	28	4.0	<.01	176	.1	140	.03	.001	.01	2.2	<.01	.01	<.01	2.00	.3	14	10	.02
658	5/6/81	7.2	.003	.04	100	<.001	44	19	<.01	235	.2	140	.05	.001	.01	5.2	<.01	.01	<.01	4.40	.5	5.9	10	.02
660	5/13/81	6.7	---	.06	84	<.001	31	8.0	<.01	---	.2	98	<.01	.001	<.01	3.5	<.01	.01	<.01	4.40	.4	5.4	10	.02
661	5/13/81	6.5	.002	.04	72	<.001	30	4.0	<.01	174	.2	94	<.01	.001	<.01	3.1	.05	.01	<.01	5.70	.4	6.1	15	.02
663	5/13/81	6.7	.001	.02	140	<.001	71	23	<.01	366	.2	210	.16	.004	<.01	6.4	<.01	.02	.09	8.70	.8	9.7	30	4.0
665	5/14/81	6.8	.002	.02	100	<.001	45	15	<.01	224	.1	130	<.01	.001	<.01	3.8	.01	.02	<.01	5.50	.4	6.9	12	.03
667	5/14/81	6.6	.003	.01	80	<.001	23	2.0	<.01	146	.1	74	<.01	<.001	<.01	3.2	<.01	.02	<.01	3.50	.4	6.7	3	.02
668	5/14/81	6.6	.002	<.01	96	<.001	49	43	<.01	308	.1	170	<.01	.001	<.01	6.1	<.01	.01	<.01	6.60	.7	12	18	.02
Nu- 205	5/18/81	6.4	.003	.01	26	<.001	9.4	2.0	<.01	48	.2	24	.12	.001	.02	1.1	<.01	<.01	<.01	.06	.2	1.4	5	.03
227	5/20/81	6.5	.001	.01	68	.001	19	2.0	<.01	146	.1	68	.03	.001	.01	2.3	.01	.01	<.01	1.50	.3	4.2	9	.01
Pe- 571	5/13/80	9.1	<.01	.04	120	<.003	2.6	1.0	<.01	174	2.2	<20	.03	<.05	<.01	.2	<.01	.01	<.01	.13	<10	51	<5	.03
582	5/14/80	7.2	<.01	.01	76	<.003	27	1.0	<.01	150	.1	83	.02	<.05	<.01	1.9	<.01	.01	<.01	2.30	<10	40	10	.01
586	5/14/80	7.1	<.01	.02	120	<.003	45	6.0	<.01	222	.1	120	.07	<.05	<.01	2.8	<.01	.01	<.01	2.00	<10	<10	45	.02
Sc- 406	4/15/81	5.9	.001	.21	19	<.01	6.2	12	<.01	50	<.1	20	.36	.004	<.01	1.3	.03	.01	<.01	1.50	.4	4.2	5	.07
453	5/7/81	6.9	.001	.03	62	<.01	44	36	<.01	276	.1	130	.11	<.001	.01	2.9	.01	.08	<.01	4.00	.4	4.7	10	.04
454	5/7/81	6.7	.001	.06	42	<.01	23	7.0	<.01	142	.1	70	.09	.026	.01	3.1	.02	.01	<.01	4.40	.6	4.4	15	.05
457	5/13/81	7.0	.004	.05	110	<.01	65	32	<.01	386	<.1	190	<.01	.001	<.01	4.7	<.01	.03	<.01	13.0	.4	8.1	12	.02
478	5/19/81	6.5	.005	<.01	70	<.01	38	6.0	<.01	228	.1	110	.05	.002	.01	3.1	<.01	.09	<.01	6.40	.3	4.9	25	.03
484	5/20/81	6.6	.002	.01	70	<.01	26	4.0	<.01	170	<.1	82	.07	.002	.01	2.0	<.01	.09	<.01	6.00	.2	4.9	<5	.05
POCONO FORMATION																								
Da- 604	5/18/81	6.4	.003	.08	44	<.001	26	5.0	<.01	122	.2	64	.03	.003	.02	2.4	<.01	<.01	<.01	.98	.3	3.9	30	.02
CATSKILL FORMATION																								
Da- 638	4/30/81	6.4	.006	.08	46	<.001	15	4.0	<.02	102	.1	68	<.01	.001	<.01	8.2	<.02	.05	<.01	1.20	.9	5.9	30	.04
Nu- 201	4/29/81	6.6	.007	.13	48	<.001	12	4.0	<.01	72	.1	28	<.01	.001	<.01	2.3	.02	.05	<.01	.18	.4	3.9	10	<.01
226	5/20/81	6.3	.002	<.01	50	<.001	8.9	2.0	<.01	132	.2	56	.07	.002	.01	4.0	<.01	.01	<.01	.54	.5	6.3	<5	.11
278	11/4/81	6.6	.002	.02	52	<.001	18	6.0	.01	134	<.1	66	.11	.001	.04	4.8	.02	.01	<.01	3.70	.5	6.7	15	.05
Pe- 575	5/13/80	6.6	<.01	.05	52	<.003	12	6	.01	122	<.1	52	.03	<.05	<.01	4.2	<.01	.02	<.01	2.00	<10	<10	<5	.01
597	5/15/80	7.1	<.01	.02	94	<.003	18	3	<.01	170	.2	82	.49	<.05	.29	9.7	<.01	.03	<.01	.02	<10	<10	5	.01
Sc- 450	5/14/81	6.6	.006	.05	52	<.001	3.5	2.0	<.01	220	1.1	29	.08	.002	.21	4.2	<.01	.04	.02	.04	.2	7.4	3	.02

TABLE 19. (CONTINUED)

Well number	Date of collection	pH	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
SHERMAN CREEK MEMBER OF CATSKILL FORMATION																								
Oa- 611	5/26/81	6.6	.005	.04	66	<.001	6.1	2.0	<.01	96	.2	26	.06	.002	.01	3.5	.01	.01	<.01	.08	1.0	14	<5	.04
623	5/27/81	6.1	.001	.03	22	.001	8.4	26	.01	154	.1	42	1.9	.002	.04	5.4	.03	.01	<.01	.60	.7	7.1	26	.05
630	4/16/81	6.5	.003	.04	84	<.001	13	5.0	<.01	138	.2	68	.57	.004	.35	8.3	.02	.01	<.01	.02	.5	8.0	5	.05
634	4/16/81	6.6	.020	.06	96	<.001	14	8.0	<.01	152	.1	76	.02	.003	.01	9.7	.02	.02	<.01	2.00	1.0	15	8	.27
642	4/30/81	6.5	.004	.03	38	<.001	8.9	4.0	<.01	56	.1	28	<.01	<.001	<.01	1.7	<.01	.06	<.01	.58	.4	6.6	4	.03
648	5/5/81	6.5	.004	.08	42	<.001	7.3	3.0	<.01	138	.2	40	.05	.001	.01	5.9	.02	.01	<.01	1.50	.6	3.4	3	.06
670	5/20/81	6.6	.048	.06	48	<.001	7.1	1.0	<.01	66	<.1	32	.03	.004	.01	5.3	<.01	<.01	<.01	.72	.8	4.9	1	.03
672	5/20/81	6.9	.020	.04	70	<.001	16	4.0	.02	138	<.1	80	.03	.004	.03	8.7	.02	<.01	<.01	3.30	.6	6.0	4	.01
673	5/20/81	6.0	.002	.05	10	<.001	3.6	4.0	<.01	52	<.1	20	.06	.005	.02	2.5	.01	<.01	<.01	3.10	.9	1.8	4	.13
675	5/20/81	6.6	.007	.02	60	<.001	20	17	<.01	168	<.1	100	.03	.003	.01	13	<.01	<.01	<.01	4.20	.8	5.2	17	.03
676	5/20/81	6.4	.004	.04	44	<.001	6.7	4.0	<.01	106	<.1	38	.02	.003	.01	6.2	<.01	<.01	<.01	3.10	.7	7.2	4	.11
Lb-1057	9/23/81	6.5	.001	.05	34	<.001	6.2	2.0	.02	62	<.1	40	.85	.001	.02	3.4	<.01	.01	<.01	.02	.5	2.6	2	.04
Pe- 530	4/30/80	7.2	<.001	<.01	42	<.003	8.6	13	<.01	116	<.1	55	.09	<.05	<.01	7.1	<.01	<.01	<.01	2.40	<10	<10	10	.03
536	5/6/80	7.7	<.01	.06	68	<.003	7.5	1.0	<.01	100	.1	20	.03	<.05	.01	2.5	.02	.02	<.01	.38	<10	18	10	.01
591	5/13/80	6.7	<.01	.03	64	<.003	9.6	2.0	<.01	104	<.1	50	.61	<.05	.11	5.0	<.01	.02	<.01	.02	<10	<10	<5	.01
Sn- 194	9/28/81	7.2	.017	.07	74	<.001	22	7.0	.02	140	<.1	84	.05	.003	.01	6.7	.02	.06	<.01	3.30	.7	6.7	5	<.01
198	9/28/81	7.4	.003	.04	90	<.001	19	6.0	.01	134	.1	94	.07	.003	.17	10	.01	.08	.02	.04	.5	7.2	15	.02
201	10/5/81	7.3	.015	.05	64	<.001	22	2.0	<.01	114	<.1	74	.07	.002	.01	5	.02	.01	<.01	.02	.4	5.1	10	.02
IRISH VALLEY MEMBER OF CATSKILL FORMATION																								
Oa- 612	5/26/81	6.2	.001	.04	28	<.001	7.0	28	<.01	110	.1	28	.26	.008	.02	4.1	.01	.01	<.01	1.50	.8	17	15	.19
613	5/26/81	6.2	.001	.11	32	<.001	3.9	6.0	<.01	56	<.1	20	.24	.001	.02	3.2	.02	.01	<.01	1.10	.5	7.2	<5	.02
649	5/5/81	7.3	.013	.05	110	<.001	18	3.0	<.01	130	.1	70	.04	.001	.01	7.6	.02	.01	<.01	.18	.4	18	3	.01
Nu- 245	5/18/81	6.9	.001	.04	130	<.001	19	1.0	<.01	156	.2	100	.20	.002	.16	7.0	<.01	.17	<.01	1.00	.3	12	5	.02
Pe- 538	5/6/80	6.8	<.01	.06	66	<.003	9.3	<1.0	<.01	54	.2	47	1.12	<.05	.21	6.0	.01	.03	<.01	<.02	<10	<10	<5	.01
592	5/13/80	6.7	<.01	.04	78	<.003	16	2.0	.01	110	.2	58	.14	<.05	.06	4.1	.01	.05	.01	.44	10	<10	<5	.01
627	5/14/80	6.9	---	<.01	68	---	11	2.0	.03	130	.2	60	.86	---	.42	5.6	.01	.05	<.01	.02	.4	7.2	10	.01
629	5/14/80	6.9	<.01	<.01	76	<.003	12	2.0	<.01	136	.2	64	.34	<.05	.11	7.1	.01	.01	<.01	.56	<10	<10	5	.01
Sc- 444	5/13/80	6.6	.01	.05	74	<.001	10	2.0	<.01	116	.2	61	.21	.001	.16	6.7	<.01	.06	<.01	.02	.4	7.1	5	.01
445	5/13/80	6.7	.003	.05	82	<.001	12	2.0	<.01	116	.2	69	.34	.002	.20	7.3	<.01	.06	<.01	.02	.4	6.7	5	.01
468	5/18/80	6.5	.004	.03	70	<.001	10	2.0	<.01	170	.2	64	.38	.001	.06	6.9	.06	.09	<.01	.04	<10	6.1	20	.04
Sn- 169	9/14/81	7.1	.001	.14	100	<.001	21	3.0	.01	132	---	82	.58	.001	.29	8.9	.01	.33	<.01	.01	.3	10	<5	.15
185	9/10/81	7.7	.001	.09	98	<.001	8.6	1.0	<.01	64	.1	40	.15	.001	.01	4.3	<.01	<.01	<.01	.10	.7	29	5	.04
TRIMMERS ROCK FORMATION																								
Oa- 615	5/26/81	6.3	.001	.06	46	<.001	8.7	2.0	<.01	106	<.1	30	.06	.001	.01	3.4	<.01	.01	<.01	.02	.4	2.3	<5	.02
637	4/16/81	6.7	.001	.06	110	<.001	16	10	.01	2	.2	62	.03	.002	.10	5.0	.03	.11	.01	.19	.4	26	10	.03
Ju- 318	5/13/81	6.7	<.01	.10	36	<.003	5.5	1.0	<.01	150	.1	34	.02	<.05	.01	2.9	<.01	.01	<.01	.04	<10	<10	10	.02
319	5/22/80	7.3	<.01	.04	70	<.003	15	2.0	<.01	176	.1	62	.02	<.05	.04	4.2	<.01	.01	<.01	.04	<10	<10	15	.01
Lb-1059	9/23/81	6.7	.002	.06	58	<.001	18	6.0	.01	72	1.0	61	.05	.002	.02	4.4	<.01	.01	<.01	1.20	.3	3.7	4	.02
1069	9/24/81	6.5	.001	<.01	40	<.001	6.1	2.0	.01	186	.2	30	1.5	.002	.03	4.3	<.01	.01	<.01	.30	.3	5.2	<5	.03
1080	10/7/81	6.4	.001	<.01	28	<.001	7.2	3.0	<.01	68	.1	30	.08	.001	.02	2.8	.01	.06	<.01	1.30	.4	4.6	10	.04
Nu- 241	5/18/81	6.3	.002	<.01	34	.001	12	6.0	<.01	136	.1	50	.23	.002	.02	4.4	.01	<.01	<.01	4.84	---	<10	<5	.23
280	11/4/81	6.5	.001	.01	38	<.001	11	1.0	<.01	74	<.1	32	.16	.001	.04	2.5	.03	.01	<.01	.72	.2	3.4	5	.12
Pe- 532	5/6/80	7.2	<.01	.04	96	<.003	23	<1.0	<.01	128	.1	78	.34	<.05	.16	5.4	<.01	.05	<.01	.02	<.01	<10	<5	.01
551	5/6/80	6.4	<.01	.05	36	<.003	3.4	1.0	<.01	64	.2	20	.83	<.05	.07	3.3	.01	23	.01	.41	<.01	<10	<5	2.12
584	5/6/80	6.8	<.01	.06	60	<.003	12	<1.0	.07	64	.1	52	.24	<.05	.12	5.2	<.01	.02	<.01	<.02	<10	<10	<5	.02
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Sc- 429	4/15/81	6.9	.001	1.0	70	<.001	14	6.0	.01	28	.2	62	4.7	.003	.10	5.0	<.01	.09	.01	.01	.5	9.1	5	.12
436	4/16/81	6.4	.001	.03	58	<.001	12	5.0	.02	72	.1	58	.24	.003	.03	4.4	.03	.01	<.01	.06	.3	6.5	<5	.001
447	5/13/81	6.3	.001	.07	24	<.001	3.7	3.0	.01	84	.2	35	.19	.002	.07	4.3	<.01	.04	<.01	.84	.2	4.4	17	.02
473	5/19/81	6.4	.001	.05	110	<.001	12	2.0	.01	154	.1	64	.04	.002	.13	6.1	<.01	.08	<.01	.20	.3	5.4	5	.02
Sn- 195	9/28/81	7.1	.001	.01	72	<.001	16	3.0	<.01	102	<.1	67	1.20	.004	.20	5.4	<.01	.25	<.01	.02	.3	8.6	10	1.3

HAMILTON GROUP

Nu- 215	10/6/81	6.9	.004	.05	110	<.001	41	2.0	<.01	126	<.1	140	1.5	.003	.19	7.1	.04	.03	<.01	.02	.4	5.5	35	.03
Sn- 152	5/13/81	6.1	.001	.03	18	<.001	5.5	2.0	<.01	74	.1	20	.44	.001	.15	2.5	<.01	.01	<.01	.50	.6	2.7	12	.03
193	9/28/81	6.5	.001	.04	26	<.001	7.7	2.0	.01	52	<.1	30	.11	---	.02	1.0	.01	.06	<.01	.02	.3	2.4	5	.02
200	9/28/81	7.4	.001	.08	118	<.001	41	2.0	<.01	168	.1	140	.16	.004	.04	6.6	<.01	.07	<.01	.02	.4	5.1	20	.02
215	9/15/81	7.6	.001	.05	66	<.001	18	4.0	<.01	---	.1	68	.05	.012	.02	4.9	.01	.37	<.01	.39	.3	6.0	10	.03
238	9/29/81	7.6	.001	.02	130	<.001	46	9.0	<.01	204	.1	160	.07	.002	.07	8.2	.01	.06	.02	2.10	.2	6.5	20	.02

MAHANTANGO FORMATION

Oa- 617	5/26/81	6.6	.001	.03	110	<.001	28	2.0	<.01	128	<.1	89	.91	.004	.16	5.6	.02	.03	<.01	.02	.6	8.7	<5	.11
Ju- 304	5/14/80	7.4	<.01	.01	76	<.003	16	<1.0	<.01	134	.2	60	.19	<.05	.08	3.9	<.01	.05	<.01	.02	<10	<10	<5	.03
Nu- 204	4/29/81	7.0	.002	.14	110	<.001	34	4.0	<.01	164	.1	110	<.01	.001	<.01	6.2	.02	.06	<.01	.56	.4	4.4	15	.02
244	5/18/81	6.7	.002	.04	90	<.001	16	1.0	<.01	140	.1	80	<.05	.003	.22	9.5	.01	<.01	<.01	<.02	.1	7.6	10	.02
Pe- 553	5/6/80	6.7	<.01	.05	58	<.003	9.4	1.0	.01	84	.2	40	.18	<.05	.10	5.0	.01	.03	<.01	.14	<10	<10	<5	.02
670	5/29/80	6.2	<.01	.07	18	<.003	2.2	1.0	.01	64	<.1	<20	.13	<.05	<.01	1.3	.03	.01	<.01	.26	<10	<10	20	.20
Sc- 427	4/15/81	6.7	.01	.03	92	<.001	26	5.0	.01	96	1.0	96	.35	.001	.26	5.1	<.01	.06	<.01	.02	.4	7.8	10	.02
433	4/16/81	6.2	.01	.04	44	<.001	6.8	10.0	.01	80	.2	55	.74	.002	.23	5.9	<.01	.04	<.01	.02	.4	6.9	10	.01
439	4/29/81	6.9	.03	.08	62	<.001	11	3.0	<.01	288	.1	38	.14	.001	.09	3.2	.05	.11	<.01	.02	.2	12	15	.05
448	5/14/81	6.7	.01	.05	66	<.001	14	3.0	<.01	136	<.1	59	.22	.001	.13	5.7	<.01	.08	<.01	.02	.3	7.9	17	.01
466	5/14/81	5.9	.02	.04	10	<.001	.3	2.0	<.01	42	.7	2	.47	.012	.01	1.5	<.01	.03	<.01	.75	.4	2.9	3	.15
469	5/18/81	6.4	.02	<.01	74	<.001	23	2.0	<.01	172	.2	75	1.2	.001	.12	3.5	<.05	.15	<.01	.02	.2	5.9	10	.02
477	5/19/81	6.7	.01	<.01	96	<.001	34	2.0	<.01	178	.2	99	.14	.001	.07	3.9	<.01	.10	<.01	.02	.2	4.9	5	.03
Sn- 155	9/9/81	6.8	.001	.06	38	<.001	15	5.0	.02	112	.9	60	.40	.003	.16	5.7	.01	.01	<.01	1.80	.5	4.5	20	.03
167	9/14/81	6.8	.001	.02	60	<.001	11	4.0	.01	86	---	45	.31	.003	.09	4.8	.01	.26	.01	.09	.4	7.5	4	.04
170	9/14/81	6.7	.001	.04	44	<.001	16	3.0	<.01	136	---	60	.20	.001	.08	7.3	.02	.30	<.01	.11	.4	7.2	34	.03
212	9/14/81	7.9	.001	.23	90	<.001	32	5.0	<.01	---	<.1	110	.16	.002	.02	6.7	.02	.31	.01	.75	.8	1.4	16	.01

ONONDAGA AND OLD PORT FORMATIONS, UNDIVIDED

Sn- 211	9/14/81	6.8	.001	.07	54	<.001	.1	6.0	.01	128	<.1	7	.03	.001	.01	<.1	.03	.37	<.01	.02	<.1	32	10	.01

KEYSER AND TONOLOWAY FORMATIONS, UNDIVIDED

Nu- 239	5/14/81	6.9	.002	.03	210	<.001	100	4.0	<.01	396	.1	350	<.01	.001	<.01	9.2	<.01	.01	<.01	15.0	.4	3.2	15	.11
240	5/18/81	7.0	.003	.02	340	<.001	170	2.0	<.01	976	.2	640	.12	.001	.02	32	.02	<.01	<.01	3.50	.2	35	5	.03
Pe- 534	5/6/80	7.4	<.01	.06	120	<.003	36	<1.0	.05	112	<.1	110	.36	<.05	.02	3.8	.02	.01	<.01	.08	<10	<10	<5	.04
544	5/8/80	7.5	<.01	.02	160	<.003	53	13.0	<.01	206	.1	180	.09	<.05	.01	15	<.01	.01	<.01	4.60	<10	<10	20	.01
Sn- 175	9/14/81	7.6	.001	.01	122	<.001	30	3.0	.01	200	<.1	150	.08	.001	.01	18	.02	.25	<.01	.05	.7	.8	31	.02
189	9/28/81	7.7	.001	.06	160	<.001	42	8.0	.01	252	.1	260	.06	.004	.01	23	<.01	.06	<.01	2.30	.6	1.6	30	.02
223	9/28/81	7.5	.001	.05	120	<.001	46	3.0	.02	160	.2	130	.15	.005	.02	2.5	.01	.07	<.01	.50	.7	.5	5	.02

WILLS CREEK FORMATION

Sn- 164	9/9/81	7.8	.001	.07	120	<.001	34	3.0	.01	200	.2	140	.06	.004	.01	13	<.01	.01	<.01	2.90	.5	2.6	15	.05
165	9/9/81	7.7	.001	.08	112	<.001	30	2.0	.01	138	.1	110	.10	.006	.01	7.2	.01	.01	<.01	.20	.4	1.9	<5	.05
177	9/9/81	7.8	.001	.09	180	<.001	72	9.0	<.01	464	<.1	330	.05	.003	.01	33	<.01	.01	<.01	4.80	1.0	1.8	110	.03
180	9/9/81	7.8	.003	.07	110	<.001	33	5.0	.01	164	.2	110	1.0	.001	.02	6.7	<.01	.01	<.01	2.60	.7	12	15	.07
225	9/29/81	7.8	.001	.02	120	<.001	31	3.0	.01	160	.1	130	.10	.003	.01	12	.01	.06	<.01	.50	.6	.6	10	.02
Un- 107	9/28/81	7.6	.001	.06	160	<.001	52	5.0	<.01	212	.2	180	.06	.003	.01	9.5	<.01	.05	<.01	1.80	.7	1.1	5	.02
108	9/28/81	7.7	.001	.01	150	<.001	36	4.0	<.01	200	.1	170	.07	.007	.01	17	.01	.05	<.01	1.90	.9	1.1	5	.06
175	10/6/81	7.6	.001	.06	180	<.001	37	1.0	<.01	200	.1	210	.17	.003	.01	27	.02	.01	<.01	.02	.6	.1	25	.03

BLOOMSBURG AND MIFFLINTOWN FORMATIONS, UNDIVIDED

Oa- 619	5/26/81	5.6	.001	.05	8	<.001	1.0	3.0	.01	36	.2	<20	.13	.005	.02	.7	.05	.01	<.01	.54	.6	1.3	<5	.02
Pe- 549	5/8/80	7.2	<.01	.03	120	<.003	19	3.0	<.01	164	.2	110	.23	<.05	.06	11	.01	.03	<.01	.04	<10	<10	15	.4
Sc- 441	4/29/81	6.1	.002	.08	22	<.001	7.1	4.0	<.01	104	.2	40	2.6	.003	.12	2.5	<.01	.05	<.01	.02	.3	3.3	15	.1
Un- 173	10/6/81	7.0	.001	.07	100	<.001	34	1.0	<.01	70	<.1	10	1.5	.003	.02	3.7	.02	.01	<.01	.66	.4	.3	5	.03

TABLE 19. (CONTINUED)

Well number	Date of collection	pH	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
CLINTON GROUP																								
Pe- 548	5/8/80	9.4	<.01	.05	210	<.003	1.1	1.0	.03	304	.8	<20	<.01	<.05	.01	.2	<.01	.05	<.01	<.02	<10	100	45	.01
Sn- 241	10/5/81	6.9	.001	.04	68	<.001	14	1.0	.01	70	<.1	70	.13	.002	.02	7.4	.03	.01	<.01	.02	.3	1.4	5	.03
JUNIATA FORMATION																								
Ce- 252	8/7/80	7.9	.01	.09	60	<.03	9.8	8.0	---	94	<.1	66	.12	<.05	.01	7.0	<.01	.01	<.01	.16	1.0	4.7	3	.02
REEDSVILLE FORMATION																								
Ce- 250	8/7/80	7.8	<.01	.04	190	<.001	44	9	<.01	254	.4	160	.02	<.05	<.001	15	<.01	.22	<.01	.02	.5	11	21	<.01
276	10/8/80	7.2	<.005	.08	86	<.001	40	7	<.01	162	.2	120	.02	<.005	<.01	9.4	.02	.10	<.01	.12	.7	5.7	5	.01
COBURN FORMATION THROUGH LOYSBURG FORMATION, UNDIVIDED																								
Ce- 247	8/6/80	7.6	<.01	.06	230	<.003	89	4.0	.01	314	.1	300	---	<.05	<.01	7.8	<.01	.01	<.01	2.80	.6	1.8	25	.03
253	8/7/80	8.1	<.01	.06	94	<.003	21	<1.0	.01	106	.2	83	.08	<.05	.06	5.2	<.01	.40	<.01	.02	2.0	6.6	6.0	.01
284	8/10/80	7.4	<.005	.10	180	<.001	61	3.0	<.01	182	.2	180	.05	<.005	.01	9.1	.02	.01	<.01	.90	.3	2.3	15	.04
352	10/22/80	7.2	<.005	.09	240	<.003	99	21	<.01	400	.2	290	.07	<.005	.01	4.0	.01	.04	<.01	8.40	3.0	4.6	20	.09
BELLEFONTE FORMATION																								
Ce- 291	10/22/80	7.5	<.005	.08	170	<.001	33	10	<.01	248	.2	180	.01	<.005	<.01	23	.02	.01	<.01	2.00	1.0	2.5	10	.01
GREAT VALLEY SECTION (WESTERN PART) MARTINSBURG FORMATION																								
Cu- 737	6/5/81	6.9	<.001	.05	114	<.001	29	7.0	.01	168	.2	120	.08	.003	.30	12	.01	.12	<.01	.54	<10	12	15	.02
786	6/16/81	7.4	<.001	.07	110	<.001	36	39	.02	326	.2	190	.28	.001	.36	16	.02	.15	<.01	.02	.9	4.0	32	.02
788	6/9/81	6.9	<.001	.08	126	<.001	28	6.0	<.01	188	.2	130	.07	.001	.16	15	<.01	.13	<.01	.04	<10	12	20	.02
818	6/9/81	6.8	<.001	.05	110	<.001	48	50	<.01	304	.1	200	.05	.002	.39	19	.03	.13	<.01	.15	<10	12	35	.02
820	6/16/81	7.6	<.001	.10	110	<.001	21	2.0	<.01	204	.2	130	.83	.001	.34	15	.01	.10	<.01	.02	1.0	6.2	26	.20
825	6/5/81	6.7	<.001	.04	74	<.001	20	2.0	<.01	148	.3	88	.57	.002	.32	9.3	.01	.03	<.01	.02	<10	<10	20	.07
830	6/9/81	7.0	<.001	.06	164	<.001	90	24	<.01	312	.2	250	.03	.001	.01	14	.02	.08	.04	.44	1.0	2.9	35	.06
831	6/16/81	7.8	.002	.08	88	<.001	33	14	<.01	210	<.1	120	.06	.002	.03	5.3	.01	.08	<.01	.02	.3	3.9	20	.07
Fr- 498	6/5/81	6.9	<.001	.06	100	<.001	31	24	.01	212	.3	130	.24	.021	.28	11	<.01	.06	<.01	.02	1.1	9.5	15	.02
528	6/5/81	6.9	.003	.06	128	<.001	27	3.0	<.01	176	.2	110	.16	.003	.32	9.6	<.01	.21	<.01	.02	<10	13	15	.02
592	6/5/81	6.7	<.001	.05	82	<.001	22	2.0	.01	132	.3	78	.40	.003	.33	5.7	.01	.05	<.01	.02	<.8	13	10	.02
606	6/4/81	7.1	<.001	.04	150	<.001	34	3.0	.01	220	.2	140	.21	.003	.29	14	.01	.20	<.01	.02	<10	10	25	.08
624	6/4/81	6.6	<.001	.06	110	<.001	29	4.0	.02	238	.2	130	.95	.002	.46	12	.02	.12	<.01	.02	1.0	7.6	35	.03
HAMBURG SEQUENCE																								
Cu- 821	6/16/81	7.6	.002	.10	146	<.001	92	74	<.01	522	<.1	330	.08	.001	.03	9.9	<.01	.08	<.01	.22	.5	7.6	68	.02
CHAMBERSBURG FORMATION																								
Cu- 424	3/10/74	7.2	---	.004	240	<.015	120	200	<.005	658	.6	460	.34	<.005	.01	38	<.005	---	---	.01	1.0	63	60	1.70

ST. PAUL GROUP																								
Cu- 476	6/5/81	7.1	<.001	.08	270	<.001	100	16	.01	400	.2	320	.03	.007	.01	19	.02	.03	<.01	6.82	<10	<10	20	.02
ROCKDALE RUN FORMATION																								
Cu- 419	6/9/81	7.0	<.001	.18	250	<.003	80	9.0	<.01	366	.2	300	.06	.002	.01	24	.01	.05	<.01	5.50	3.0	13	20	.18
ZULLINGER FORMATION																								
Cu- 418	6/30/81	---	<.001	1.10	---	<.001	100	---	---	---	---	---	.04	.003	---	29	.02	---	---	---	42	9.3	---	.05
523	6/9/81	7.0	<.001	.06	240	<.001	94	21	<.01	432	.2	290	.08	<.001	.01	14	.02	.01	<.01	16.0	13	<10	25	.17
Fr- 666	6/4/81	6.9	<.001	.07	170	<.001	73	30	.01	322	.2	220	.06	.002	.01	8.3	<.01	.02	<.01	5.90	<10	<10	20	.11
ELBROOK FORMATION																								
Cu- 545	9/10/81	7.5	<.001	.07	224	<.001	98	18	.01	452	.2	310	.05	.002	.01	15	.02	<.01	<.01	13.0	13	8.2	35	.08
826	6/16/81	7.6	.001	.08	220	<.001	50	4.0	.01	308	<.1	230	.04	.002	.01	26	.01	.08	<.01	1.60	1.0	.2	25	.02
GREAT VALLEY SECTION (EASTERN PART) MARTINSBURG FORMATION																								
Oa- 579	6/2/81	7.1	.002	.03	130	<.001	48	4.0	<.01	224	.2	120	.09	.001	.22	6.7	.01	.10	<.01	.02	.5	10	9	<.01
580	6/2/81	6.6	.001	.04	66	<.001	30	8.0	<.01	144	.3	100	.06	.001	.03	6.1	.02	.05	<.01	.30	.4	1.5	7	.46
581	6/2/81	7.0	.001	.05	140	.001	66	52	.01	350	.1	230	.38	.004	.35	15	.01	.16	<.01	.02	.6	18	4	.05
583	6/2/81	6.7	<.001	.05	110	<.001	45	3.0	<.01	200	<.1	120	.63	.001	.23	7.6	<.01	.07	<.01	.02	.5	4.6	14	---
590	6/2/81	7.0	<.001	.03	130	<.001	37	2.0	<.01	200	.2	100	.04	.031	.01	7.7	<.01	.07	<.01	.74	.9	1.3	3	.02
Lb-1022	8/20/81	7.1	.001	.32	88	<.001	22	6.0	<.01	142	.2	87	.76	.003	.27	7.2	<.01	.05	<.01	.06	.9	8.3	8	.04
HAMBURG SEQUENCE																								
Be- 698	6/15/81	7.4	.001	.09	156	<.001	68	13	<.01	298	<.1	230	.05	.002	.01	7.4	.01	.06	<.01	6.20	.5	3.6	29	.15
1285	7/13/81	8.0	.005	.04	140	<.001	32	2.0	<.001	196	<.1	130	.13	.002	.12	11	.01	.04	<.01	.06	.7	9.6	11	.02
1286	6/15/81	7.9	.001	.02	110	<.001	29	3.0	<.01	176	<.1	110	.16	.002	.05	6.8	<.01	.14	<.01	.24	1.0	4.4	8	.02
Oa- 584	6/11/81	6.7	.004	.02	100	<.001	46	9.0	.02	272	<.1	150	.13	.004	.09	5.3	<.01	.01	<.01	.02	.6	8.3	45	.02
Lb- 864	6/15/81	7.8	.003	.08	74	<.001	30	5.0	<.01	166	<.1	30	.05	.002	.01	3.5	<.01	.06	<.01	4.00	1.0	1.7	12	.03
865	6/15/81	7.5	.001	.08	160	<.001	66	44	<.01	388	<.1	280	.83	.001	.37	15	.01	.12	<.01	.02	.8	3.9	39	.12
867	6/15/81	7.7	.004	.09	142	<.001	48	12	<.01	320	<.1	180	.14	.001	.27	15	<.01	.10	<.01	.02	1.0	6.9	54	.02
869	6/11/81	6.9	.003	<.01	100	<.001	21	2.0	.01	174	<.1	75	.09	.002	.02	5.4	<.01	.08	<.01	.02	.8	11	<5	.03
871	6/2/81	6.8	<.001	.04	140	<.001	51	7.0	<.01	230	.1	150	.76	<.001	.33	13	.01	.06	<.01	.02	.7	5.9	12	.02
873	6/18/81	7.3	.002	.05	200	<.001	130	120	<.01	799	<.1	350	.38	.006	.02	9.6	.05	.05	<.01	4.40	.7	7.7	41	.03
876	6/18/81	7.6	.003	.06	86	<.001	22	13	<.01	168	<.1	78	.08	.004	.07	5.6	.05	.05	<.01	.36	.8	9.5	8	.02
878	6/15/81	7.8	.003	.09	80	<.001	28	6.0	<.01	200	<.1	90	.15	.002	.33	4.9	<.01	.17	<.01	.02	.4	2.8	18	.01
903	7/23/81	6.8	.001	.08	120	<.001	38	17	<.01	260	<.1	160	2.4	.005	.04	20	.02	.10	<.01	1.20	.4	5.2	28	.02
913	7/9/81	6.3	.001	.06	24	<.001	5.2	4.0	.01	122	.2	34	1.6	.008	.07	4.6	<.01	.06	<.01	6.60	1.0	9.0	10	.20
914	7/9/81	6.1	.001	.08	60	<.001	13	2.0	<.01	114	.3	49	2.0	.009	1.1	3.7	.01	.06	<.01	.02	.9	5.9	5	.02
915	7/9/81	7.5	.001	.07	78	<.001	17	2.0	<.01	148	.1	54	.01	.002	.14	5.0	<.01	.06	<.01	.02	1.0	7.8	10	.02
918	7/8/81	7.1	.001	.07	98	<.001	24	2.0	.001	158	.1	83	.89	.004	.76	5.8	.01	.08	.01	.01	1.0	7.4	10	.02
921	7/8/81	6.4	.001	.12	42	<.001	5.5	6.0	<.01	118	<.1	40	8.9	.001	1.7	5.1	.01	.11	<.01	.02	2.0	6.7	5	.05
923	7/8/81	8.0	.001	.04	130	<.001	24	2.0	<.01	176	.2	97	.11	.001	.06	9.9	.01	.12	<.01	.02	1.0	17	5	.02
924	7/8/81	8.5	<.001	.04	100	.001	18	2.0	<.01	168	.2	45	.33	.48	.03	3.3	.01	.13	<.01	.02	2.0	24	10	.14
940	7/15/81	6.7	.001	.05	60	<.001	19	14	<.01	154	.1	77	2.1	.002	1.3	61	<.01	.02	<.01	.02	.4	4.9	22	.04
944	7/15/81	7.5	.001	.13	120	<.001	32	1.0	<.01	164	<.1	110	.12	.006	.11	8.4	<.01	.03	<.01	.08	.8	2.5	21	.01
948	7/15/81	7.0	.001	.18	74	<.001	17	18	<.01	154	.1	76	.07	.003	.01	8.2	<.01	<.01	<.01	1.40	.9	9.8	18	.05
950	7/15/81	7.3	.001	.07	84	<.001	25	9.0	<.01	150	<.1	83	.79	.005	.44	6.0	<.01	.07	<.01	.06	.4	5.3	20	.03
951	7/15/81	7.2	.001	.16	80	<.001	16	3.0	<.01	120	.1	65	.40	.002	.30	7.0	<.01	.02	<.01	<.02	.4	6.1	17	.01
954	7/16/81	7.5	.001	.19	170	<.001	86	8.0	<.01	360	<.1	270	.04	.007	.02	7.7	.03	.04	<.01	13.0	.5	3.4	45	.03
957	7/23/81	8.0	.001	.08	84	<.001	18	3.0	.01	118	.2	68	.2	.002	.03	6.4	.03	.07	.03	.43	1.0	9.7	8	.03
960	7/23/81	7.5	.001	.07	130	<.001	57	7.0	.01	220	<.1	150	.03	.004	.03	7.3	.02	.07	<.01	3.7	.8	5.2	14	.02
962	7/23/81	6.8	.001	.05	50	<.001	15	6.0	.01	148	<.1	64	<.01	.005	.02	6.8	.01	.08	<.01	4.2	.8	7.7	5	.07
963	7/23/81	7.1	.002	.09	84	<.001	26	10	.01	182	<.1	100	1.5	.001	.68	9.3	<.01	.10	<.01	.02	.4	6.2	20	.05
965	7/23/81	7.6	.002	.05	140	<.001	73	4.0	.01	148	.1	180	.01	.002	.04	3.7	.01	.09	<.01	.02	.6	3.8	39	.04
966	7/23/81	6.9	.002	.08	70	<.001	23	14	.04	168	.1	82	2.3	.007	1.8	7.1	.03	.07	<.01	.02	.7	8.6	13	.02
967	7/29/81	6.7	.002	.05	60	<.001	13	4.0	<.01	90	.1	68	1.1	.003	2.2	9.0	.01	.13	<.01	.02	.4	3.0	5	.04
968	8/12/81	7.1	.002	.12	110	<.001	38	11	<.01	202	.1	130	.37	.004	.90	8.7	.01	---	<.01	1.10	.3	2.1	6	.04

TABLE 19. (CONTINUED)

Well number	Date of collection	pH	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
GREAT VALLEY SECTION (EASTERN PART) HAMBURG SEQUENCE (CONTINUED)																								
Lb- 970	7/29/81	7.6	.001	.05	96	<.001	54	50	<.01	310	1	180	.08	.003	10	10	.01	.06	<.01	.02	<.1	8.9	30	.02
971	7/29/81	7.8	.002	.07	100	<.001	39	5.0	<.01	264	.1	150	.16	.002	.23	11	<.01	.10	<.01	.02	<.1	18	5	.02
973	7/29/81	7.1	.002	.06	64	<.001	34	6.0	<.01	200	<.1	120	.14	.001	.01	7.7	.01	.05	.01	3.7	.3	5.2	40	.02
976	7/30/81	7.6	.002	.05	110	<.001	45	3.0	.02	184	.1	130	.09	.002	.09	4.7	.04	.05	<.01	.02	.2	3.3	20	.02
978	7/30/81	7.5	.003	.05	80	<.001	43	10	<.01	230	.1	140	.06	.002	.21	7.1	.02	.05	.03	.35	.3	4.8	45	.03
979	7/30/81	7.3	.002	.07	74	<.001	31	4.0	<.01	134	.1	100	.21	.007	.18	5.2	.02	.05	<.01	.02	.2	4.8	25	.02
983	7/30/81	7.8	.003	.02	100	<.001	15	2.0	<.01	110	<.1	62	.23	.002	.01	4.2	.02	.05	<.01	.52	.4	23	<5	.02
986	8/12/81	8.2	.001	.03	220	<.001	29	18	.02	282	8	98	.05	.001	.02	11	.03	.22	<.01	.02	1.0	68	22	.17
987	8/12/81	7.8	.002	.02	150	<.001	43	4.0	<.01	228	.3	170	.08	.001	.01	15	.01	.06	<.01	2.20	.7	6.5	17	.03
990	8/12/81	7.9	.002	.06	92	<.001	44	10	<.01	216	.2	140	.04	.002	.01	7.5	.01	.06	<.01	.40	.2	5.4	51	.03
993	8/12/81	7.7	.001	.04	90	<.001	30	5.0	<.01	156	2	100	.10	.004	.01	8.0	.01	.06	<.01	4.40	.7	3.5	<5	.03
994	8/12/81	6.9	.001	.04	44	<.001	7.3	8.0	<.01	92	.3	52	.41	.002	1.2	7.8	.01	.08	.01	.15	1.0	.8	5	.04
997	8/12/81	7.6	.001	.11	88	<.001	38	18	<.01	210	.2	130	.14	.002	.01	6.4	<.01	.06	<.01	3.30	.5	2.9	14	.03
1003	8/13/81	7.7	.001	.05	140	<.001	44	2.0	<.01	184	1	140	.18	.003	13	6.6	<.01	.09	<.01	.02	.5	3.4	8	.04
1007	8/19/81	6.7	.001	.08	54	<.001	25	20	<.01	138	2	80	1.1	.005	1.6	4.2	.04	.08	<.01	.02	.8	.9	<5	2.0
1009	8/19/81	7.7	.002	.10	190	<.001	49	7.0	.01	242	.2	180	.03	.001	.03	18	.04	.12	<.01	.49	.5	12	10	.03
1011	8/19/81	7.5	.001	.09	180	<.001	51	4.0	.01	252	.1	190	.60	.001	.04	11	.04	.09	<.01	.02	1.0	7.4	22	---
1013	8/19/81	7.6	.001	.10	140	<.001	36	3.0	<.01	184	.3	130	.04	.006	.01	9.3	.05	.11	.04	.21	.3	7.3	<5	.10
1014	8/19/81	6.7	.001	.07	62	<.001	19	10	.03	134	.3	98	.08	.006	.23	8.1	.02	.17	.01	3.70	.3	2.5	8	.35
1016	8/20/81	7.4	.001	.09	200	<.001	150	110	.01	706	.2	370	.09	.004	.02	11	.02	.06	<.01	5.30	.7	9.1	35	.05
1018	8/20/81	7.4	.001	.08	100	<.001	49	6.0	<.01	200	.2	130	.24	.001	.01	6.7	.01	.06	<.01	.50	.4	3.0	21	.05
1035	9/2/81	7.7	.003	.03	130	<.001	40	3.0	<.01	228	.3	160	.14	.007	.01	14	.02	.06	<.01	1.80	.7	3.3	15	.03
1036	9/2/81	7.6	.005	.04	190	<.001	74	9.0	<.01	284	6	190	.05	.004	.01	9.9	.02	.10	<.01	.19	.6	10	25	.01
1063	7/23/81	7.0	.001	.05	92	<.001	44	5.0	.01	156	.2	120	.33	.002	.01	3.3	<.01	.01	<.01	2.40	.5	3.9	20	.05
1064	9/23/81	7.1	.001	.04	160	<.001	78	20	<.01	302	1	290	.06	.005	<.01	8.1	.01	.01	<.01	5.70	.8	5.3	22	.02
1065	9/23/81	6.9	.001	.05	92	<.001	28	8.0	<.01	102	.2	87	.18	.001	.43	6.5	.01	.01	<.01	.02	.3	4.6	2	.02
1067	9/24/81	6.8	.001	.06	140	<.001	29	12	.01	200	.2	88	2.3	.002	.65	5.1	<.01	.17	<.01	.02	.6	31	12	.02
1074	9/24/81	7.3	.001	.04	92	<.001	25	8.0	.01	144	.2	83	.07	.002	.01	6.5	<.01	.01	<.01	.46	.6	7.4	4	.02
1078	9/24/81	6.6	.001	.07	72	<.001	17	6.0	.01	94	.1	74	.06	.001	.02	8.8	<.01	.01	<.01	.72	.6	5.5	6	.02
EPLER FORMATION																								
Oa- 588	6/11/81	6.9	.004	.07	210	.001	51	32	.02	406	.2	310	.08	.005	.01	28	<.01	.06	<.01	1.7	1.0	15	25	1.1
Lb- 488	2/6/81	7.0	.001	.04	241	<.001	95	34	.03	518	.2	380	.05	.003	.02	29	.03	.05	.01	4.2	1.0	14	34	.48
858	6/11/81	6.8	.002	<.01	190	<.001	78	35	.01	534	<.1	240	.04	.002	.01	12	.01	.06	<.01	15	4.0	17	20	.02
SNITZ CREEK FORMATION																								
Lb- 872	1/5/81	7.6	<.005	.04	180	<.001	63	14	.01	232	<.1	240	.09	<.005	.01	6.1	.02	.61	<.01	.06	2.0	3.5	5	.01
953	10/7/81	7.5	.001	.11	240	<.001	69	17	<.01	414	.2	270	.11	.001	.02	38	.02	.06	<.01	7.60	6.0	7.2	55	.03
BUFFALO SPRINGS FORMATION																								
Lb- 173	7/14/81	7.5	<.001	.06	180	<.001	67	18	.01	330	.2	250	.04	.003	.01	21	.02	.01	<.01	8.4	2.0	7.7	28	.09
564	9/1/81	7.6	.004	.04	250	<.001	88	50	<.01	484	.5	240	.05	.003	.01	25	.03	.06	<.01	6.8	5.0	28	25	.05

TRIASSIC LOWLAND SECTION GETTYSBURG FORMATION																								
Ad- 481	6/30/81	---	.002	.1	---	<.001	34	---	---	---	---	130	.06	.003	.01	11	.02	---	---	---	.9	7.6	---	.01
574	6/30/81	---	.003	.1	---	<.001	60	---	<.01	---	---	270	1.6	.009	.03	30	.02	---	---	---	1.0	12	---	.05
575	6/30/81	---	.006	.08	---	<.001	88	---	<.01	---	---	250	.08	.003	.01	7.9	.02	---	---	---	.4	13	---	.06
576	6/30/81	---	.002	.10	---	<.001	69	---	.01	---	---	260	.04	.002	.01	22	.02	---	---	---	1.0	8.0	---	.03
577	7/6/81	7.2	.001	.06	130	<.001	32	18	.01	246	.1	150	.04	.002	.01	17	.01	.01	<.01	1.30	1.0	11	15	.03
579	7/6/81	7.5	.001	.10	240	<.001	68	23	<.01	412	<.1	350	.11	.003	<.01	25	.01	.01	<.01	4.60	.6	13	15	.02
583	9/10/81	8.0	.002	.08	110	<.001	36	10	.01	194	<.1	120	.06	.003	.05	8.1	<.01	.01	.02	.29	.3	19	30	.01
584	9/10/81	7.2	<.001	.07	100	<.001	38	6.0	.01	258	.3	140	.04	.001	.01	12	.01	<.01	<.01	4.40	.5	4.9	25	.03
586	6/30/81	---	.002	.08	---	<.001	45	---	<.01	---	---	160	.08	.005	.01	12	.02	---	---	---	1.0	11	---	.32
Oa- 586	8/31/81	7.6	.004	.06	106	<.001	56	9.0	.02	288	<.1	160	.04	.003	.02	5.5	.02	.01	.02	9.90	.9	6.8	25	.03
Ln-1321	7/9/81	7.9	<.001	.08	110	<.001	24	4.0	<.01	180	---	80	3.4	.009	.04	6.8	.01	.06	<.01	1.50	.3	20	15	.79
1499	7/14/81	5.6	<.001	.05	11	<.001	6.4	31	.01	100	<.1	42	.07	.004	.01	2.2	.02	.01	<.01	.58	.7	13	5	.03
Lb- 845	7/14/81	7.5	.002	.04	230	<.001	98	66	.01	526	<.1	380	.05	.003	.01	24	.04	<.01	<.01	4.60	.6	15	46	.09
874	7/10/81	5.7	<.001	.07	8	<.001	2.1	8.0	<.01	42	<.1	< 20	.05	.012	.03	1.4	<.01	.06	<.01	1.30	1.0	4.1	5	.02
879	8/31/81	6.0	.002	.07	11	<.001	2.1	3.0	<.01	66	<.1	< 20	.07	.005	.03	1.7	<.01	.01	<.01	1.30	2.0	2.8	5	.03
Yo-1071	7/7/81	7.5	<.001	.09	230	<.001	90	34	<.01	472	<.1	370	.06	.002	<.01	14	<.01	.01	<.01	5.10	2.0	18	40	.02
1089	6/16/81	7.7	.002	.09	150	<.001	68	20	<.01	378	<.1	220	.55	.008	.01	7.8	.01	.08	<.01	4.60	.9	3.1	30	.11
1093	7/6/81	6.5	<.001	.10	46	<.001	28	9.0	<.01	224	<.1	100	.06	.002	<.01	8.3	<.01	.01	<.01	8.60	1.0	8.9	20	.01
HAMMER CREEK FORMATION																								
Be-1284	6/25/81	7.1	.002	.20	100	<.001	61	37	.03	266	.1	160	.11	.005	.02	10	.05	.08	<.01	1.80	.3	7.7	5	.05
Ln-1441	6/29/81	6.0	.001	.07	22	<.001	4.7	4.0	.04	86	<.1	29	.06	.004	.04	2.9	.03	.06	<.01	2.60	1.0	4.9	< 5	.03
1466	6/29/81	6.4	.001	.04	40	.002	5.5	4.0	<.01	156	<.1	46	.09	.008	.02	6.5	.03	.07	<.01	1.20	.6	7.6	5	.47
1480	7/14/81	6.3	<.001	.07	36	<.001	20	6.0	.01	136	<.1	74	.12	.004	.04	1.9	.01	.01	<.01	6.60	1.0	4.5	5	.16
1481	7/14/81	7.0	<.001	.05	82	<.001	41	8.0	.01	188	<.1	130	.12	.004	.01	2.9	.01	.01	<.01	6.80	---	6.4	13	.03
Lb-1096	10/7/81	6.4	.001	.09	52	<.001	18	6.0	<.01	130	.6	64	.01	.001	.02	3.8	.02	.06	<.01	1.40	.6	1.1	5	.03
NEW OXFORD FORMATION																								
Ad- 110	7/6/81	6.9	<.001	.08	86	<.001	20	4.0	.01	172	<.1	86	.11	.001	.02	8.8	.01	.01	<.01	3.70	.4	8.2	< 5	.03
578	7/6/81	7.9	.002	.06	130	<.001	42	8.0	.01	206	<.1	130	.04	.001	.01	8.1	.01	.01	<.01	2.40	.7	9.8	10	.04
Ln-1508	7/9/81	6.1	.001	.07	12	<.001	7.6	7.0	.01	150	<.1	40	.03	.04	.02	3.3	---	.07	<.01	6.40	1.0	12	10	.02
Yo-1065	6/25/81	7.8	.004	.01	100	<.001	26	3.0	<.01	150	.2	89	.03	.001	<.01	5.8	.02	.01	<.01	2.40	.8	14	< 5	.02
1067	6/7/81	6.4	<.001	1.0	52	<.001	29	23	<.01	270	<.1	110	.12	.002	.01	7.8	<.01	.01	<.01	9.00	.7	13	15	.07
CONESTOGA VALLEY SECTION COCALICO FORMATION																								
Ln-1438	7/21/81	7.6	.001	.06	100	<.001	48	9.0	.01	208	<.1	140	.13	.001	.02	4.8	.02	.06	<.01	2.00	.6	2.3	35	.04
1440	7/21/81	6.7	<.001	.06	66	<.001	31	13	.01	192	<.1	110	.75	.001	.54	6.1	.02	.06	<.01	.44	1.0	5.7	35	.04
1450	8/31/81	6.9	.003	.06	82	<.001	30	7.0	.01	200	<.1	91	.03	.003	.03	3.5	<.01	.01	<.01	9.20	1.0	4.8	10	.02
1489	7/13/81	6.9	<.005	.10	62	<.001	36	10	.01	200	<.1	130	.03	<.005	.01	6.5	.02	.02	<.01	4.8	.7	4.5	35	.02
1490	6/25/81	6.6	.001	.20	48	<.001	48	21	<.01	208	<.1	110	.08	.008	.02	4.8	.03	.07	<.01	2.80	2.0	4.6	34	.03
1497	7/21/81	6.2	.001	.06	38	<.001	20	14	.01	182	<.1	85	.02	.004	.01	7.0	.01	.06	<.01	11.0	.8	4.6	< 5	.03
1498	7/21/81	6.3	<.001	.09	38	<.001	23	6.0	.01	152	<.1	84	.05	.008	.01	4.8	.01	.06	<.01	4.20	.8	2.6	20	.08
1506	11/20/80	7.3	.006	.08	160	<.001	54	4.0	.01	296	.1	180	.10	<.005	.17	6.2	.03	.01	<.01	.02	.2	7.1	45	.01
ONTELAUNEE FORMATION																								
Ln-1446	7/13/81	7.5	.003	.07	200	<.001	86	23	.01	416	<.1	280	.05	.002	<.01	16	.02	.01	<.01	16.0	1.0	7.1	17	.12
EPLER FORMATION																								
Ln-1036	7/21/81	7.4	.001	.05	230	<.001	87	19	.01	384	<.1	310	.09	.003	.02	20	.02	.06	<.01	9.70	2.0	5.9	28	.12
1436	7/21/81	7.5	.002	.20	240	<.001	100	20	.01	396	<.1	320	.03	.001	.03	19	.02	.06	<.01	2.90	1.0	6.0	80	.04
1462	6/29/81	7.1	.001	.10	260	<.001	140	110	.01	864	.1	460	.06	.004	.02	28	.02	.06	<.01	17.0	4.0	64	42	.02
1495	6/29/81	7.5	<.001	.10	200	<.001	89	14	.01	440	<.1	270	.11	.002	.01	21	.02	.06	<.01	14.0	1.0	5.6	16	.11
1496	6/25/81	7.6	.002	.20	250	<.001	88	15	<.01	424	.6	340	.07	.003	.02	38	.03	.08	.12	3.00	1.0	7.7	8	.03

TABLE 19. (CONTINUED)

Well number	Date of collection	pH	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
STONEHENGE FORMATION																								
Ln-1469	8/31/81	7.7	.003	.04	220	<.001	98	16	<.01	450	<.1	370	.04	.004	.02	26	---	.01	<.01	12.0	1.0	9.1	45	.05
CONESTOGA FORMATION																								
Ln-1425	8/18/81	7.2	.002	.20	240	<.001	140	30	.01	666	.2	450	.14	.087	.02	25	.01	<.01	<.01	31.0	5.0	10	85	.05
1491	9/14/81	7.3	.001	.08	230	<.001	110	50	.01	502	.2	380	.10	.001	.01	14	.01	.03	<.01	5.90	2.0	26	5.9	.09
1492	9/14/81	7.6	.001	.05	160	.001	58	14	.02	366	<.1	250	.39	.002	.02	21	<.01	.05	<.01	.02	4.0	4.8	53	.10
1501	12/11/80	7.2	<.005	.03	230	<.001	76	17	.04	468	.4	280	.07	<.005	.01	21	.03	.06	<.01	13.0	10	4.9	65	.05
1503	9/3/81	5.7	.005	.08	8	<.001	5.1	19	.01	190	<.1	34	.16	.046	.02	5.1	.03	.09	<.01	7.30	2.0	9.1	<5	.03
Yo-1095	7/23/81	7.2	.001	.07	200	<.001	120	24	.01	486	.1	380	.14	.002	.02	14	.01	.01	<.01	17.0	1.0	6.2	27	.05
MILLBACH FORMATION																								
Ln-1449	6/25/81	7.4	.001	.20	240	<.001	97	15	.01	406	.2	340	.17	.001	.02	16	.04	.05	<.01	11.0	1.1	5.3	35	.04
SNITZ CREEK FORMATION																								
Ln-1493	6/25/81	7.4	.001	.20	210	<.001	65	12	.01	304	.6	300	.08	.002	.01	24	.05	.08	<.01	2.9	3.0	5.3	37	.09
SNITZ CREEK AND BUFFALO SPRINGS FORMATIONS, UNDIVIDED																								
Ln-1485	7/27/81	7.3	.002	.09	250	<.001	110	20	.02	806	<.1	400	<.01	.005	.01	31	.02	.01	<.01	33.0	2.0	4.2	40	.02
1507	7/9/81	7.5	.001	.20	290	<.001	88	16	<.01	498	<.1	390	.07	.006	.02	40	.01	.09	<.01	2.20	4.0	5.3	40	.03
BUFFALO SPRINGS FORMATION																								
Ln- 920	7/7/81	7.4	<.001	.08	225	<.001	90	7.0	.01	334	.2	330	.06	.001	.01	13	.02	.01	<.01	9.70	4.0	5.8	20	.10
ZOOKS CORNER FORMATION																								
Ln- 797	9/14/81	7.3	.002	.30	340	<.001	120	99	.01	878	<.1	400	1.2	.002	.05	69	.01	.09	<.01	31	9.0	100	49	.40
1459	7/7/81	7.1	.001	.08	340	<.001	130	440	.01	1500	.1	570	.09	<.001	.21	72	.02	.60	.01	9.5	6.0	240	65	.30
1461	7/20/81	7.3	<.001	.08	300	<.001	96	37	.01	706	.2	550	.05	.001	.02	61	.02	.06	<.01	8.4	2.0	34	160	.06
LEDGER FORMATION																								
Ln-1431	7/20/81	7.6	.001	.09	110	<.001	41	50	<.01	346	<.1	200	.08	.003	.02	22	.01	.06	.03	15.0	.4	6.2	<5	.03
1444	7/7/81	7.4	.001	.06	220	<.001	65	23	<.01	424	<.1	280	.02	.004	.01	35	.01	.01	<.01	16.0	6.0	14	15	.14
1453	7/20/81	7.5	.001	.08	240	<.001	62	25	.01	380	<.1	380	.04	.002	.01	38	.01	.08	.04	9.50	1.0	3.7	5	.03
1457	7/20/81	7.7	.001	.10	230	<.001	86	20	.03	440	.1	350	.06	.002	.02	29	.03	.06	<.01	9.20	1.0	5.3	72	.16
1468	7/7/81	7.4	.001	.08	250	.001	83	23	.01	456	<.1	320	.06	.002	.01	37	.02	.01	<.01	12.0	4.0	11	40	.30
1488	8/31/81	7.6	.001	.05	260	<.001	80	20	.02	554	<.1	400	.05	.004	.02	50	.01	.01	<.01	16.0	.4	4.5	25	.05
1505	7/9/81	7.7	.001	.08	250	<.001	71	40	<.01	450	.4	380	.02	.008	.02	38	.01	.08	<.01	15.0	3.0	17	25	.09
KINZERS FORMATION																								
Ln- 538	7/9/81	7.3	<.001	.06	100	<.001	34	7	.01	200	<.1	130	.05	.005	.02	12	.01	.09	<.01	6.60	2.0	2.1	80	.03
1435	7/7/81	7.6	.001	.07	240	<.001	66	22	.01	452	<.1	270	.03	.003	.01	34	.01	.03	<.01	3.50	1.0	11	40	.11
1460	7/7/81	7.6	.002	.09	240	<.001	100	39	.01	490	<.1	290	.08	.002	.01	29	.02	.01	<.01	9.50	1.0	11	50	.08
Yo- 347	7/30/81	7.4	.001	.02	150	<.001	41	7	<.01	210	.2	140	.12	.004	.01	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

VINTAGE FORMATION

Ln-1445	7/20/81	7.3	.001	.08	330	<.001	87	25	.01	570	.1	430	.04	.004	.02	38	.02	.01	<.01	16.0	2.0	32	41	.08
1473	12/11/80	7.3	<.005	.05	160	<.001	66	31	<.01	348	<.1	200	.03	<.005	<.01	9.1	.01	.01	<.01	5.00	2.0	2.9	<1	.06
1500	7/7/81	7.7	<.001	.07	170	<.001	47	18	.01	262	<.1	270	.04	<.005	.01	22	.02	.01	<.01	6.40	2.0	7.2	5	.02

ANTIETAM FORMATION

Ad- 568	7/23/81	7.3	.001	.08	150	<.001	76	42	.01	342	.2	280	.46	.002	.32	10	.01	.01	<.01	.66	.4	21	50	.01
Yo- 714	6/25/81	5.7	.001	.40	8	<.001	6.5	9.0	<.01	82	1.2	44	.12	.001	.02	5.2	<.01	.01	<.01	6.60	1.2	3.8	<4	.02
1086	7/30/81	7.5	.001	.02	110	<.001	34	3.0	.01	182	<.1	110	.09	.007	.09	6.8	.02	.05	<.01	.16	.9	9.1	15	.11
1113	6/25/81	5.9	.001	.10	15	<.001	8.9	8.0	<.01	86	<.1	41	.06	.004	.02	1.7	<.01	.01	<.01	4.00	2.0	9.1	11	.03
1115	6/25/81	7.6	.001	.08	84	<.001	20	5.0	.01	126	<.1	97	.26	.002	.02	11	<.01	.01	<.01	.36	.8	3.0	13	.10

HARPERS FORMATION

Yo- 324	8/27/81	6.9	.003	.07	72	<.001	42	28	<.01	268	<.1	140	.02	.003	.07	8.1	.02	.06	<.01	6.20	1.0	15	30	.16
327	7/23/81	6.0	.001	.03	28	<.001	20	32	.01	228	<.1	90	.09	.008	.32	6.9	.02	.01	.10	7.50	3.0	25	36	.02
788	6/25/81	6.9	.001	.10	72	<.001	22	5.0	<.01	168	<.1	83	.27	.001	.12	6.8	.02	.01	<.01	1.70	2.0	9.9	25	.03
1068	8/27/81	6.3	<.001	.08	36	<.001	17	14	<.01	174	<.1	66	.27	.003	.09	5.4	.01	.08	<.01	1.70	1.0	14	25	.13
1084	8/27/81	7.0	.002	.09	110	<.001	51	16	<.01	308	<.1	190	.03	.004	.02	15	.02	.01	<.01	2.40	7.0	8.9	50	.05
1090	6/25/81	5.7	.001	.09	13	<.001	7.2	11	<.01	102	<.1	45	.06	.003	.07	4.3	<.01	.01	<.01	7.60	3.0	8.8	5	.04

CHICKIES FORMATION

Yo-1079	8/27/81	5.8	.001	.20	5	<.001	3.2	3.0	<.01	50	<.1	<20	.01	.013	.01	1.1	.01	.06	<.01	.84	.4	1.8	5	.02
1096	7/30/81	5.7	.002	.03	8	<.001	4.0	2.0	<.01	34	.3	12	.20	.016	.02	.5	.01	.07	<.01	.04	.6	1.1	<5	.06
1104	6/25/81	5.6	.001	.07	5	<.001	4.0	35	<.01	100	<.1	50	.10	.003	.03	7.2	<.01	.01	<.01	5.10	1.0	15	8	.05

PIEDMONT UPLANDS SECTION
GRANITIC GNEISS AND GRANITE

Ch-2420	7/20/81	7.3	<.001	.02	68	<.001	47	18	<.01	236	<.1	130	.04	.005	.01	.1	.01	.01	<.01	3.30	2.0	3.8	35	.02
Ln-1411	9/14/81	5.9	.001	.05	15	<.001	29	28	.01	394	<.1	120	.04	.005	.01	11	---	.01	<.01	26	2.0	11	3	.03
1414	9/3/81	6.7	.002	.10	56	<.001	15	4	<.01	118	.7	62	3.7	.006	.30	6.4	.02	.06	<.01	.02	3.0	1.6	5	.08
1479	9/14/81	5.7	.002	.10	8	<.001	18	30	.01	236	<.1	100	.11	.008	.02	12	<.01	.01	<.01	5.9	3.0	9.3	56	.02

PETERS CREEK SCHIST

Ch-1726	7/20/81	6.1	.001	.02	35	<.001	22	8.0	<.01	196	<.1	69	.09	.01	.08	3.5	.02	.05	<.01	14.0	.6	4.3	8	.07
2421	7/20/81	5.9	<.001	.03	20	<.001	23	29	<.01	264	<.1	110	.05	6.9	.02	8.9	.01	.05	<.01	13.0	.7	15	26	.04
Ln-1415	7/20/81	6.0	<.001	.03	38	<.001	24	25	.01	288	<.1	110	.05	.004	.03	9.6	.01	.05	<.01	12.0	1.0	9.6	11	.02
1416	9/14/81	5.9	.001	.07	8	<.001	4	7.0	.01	86	<.1	23	.10	.002	.01	2.9	<.01	.01	<.01	3.50	.3	3	1	.02
1417	9/3/81	6.2	<.001	.08	19	<.001	4.6	6.0	.01	66	<.1	20	.09	.007	.05	2.3	.02	.11	<.01	1.20	.3	3.9	<5	.14
1418	8/4/81	6.5	.001	.07	26	<.001	4	5.0	<.01	138	4	42	.12	.002	.01	8.2	.01	.10	<.01	5.10	.4	5.2	4	.20
1419	8/4/81	6.9	.001	.08	60	<.001	32	8.0	<.01	200	<.1	68	.04	.003	.01	4.4	.01	.10	<.01	6.20	.2	3.5	10	.04
1471	7/20/81	5.7	<.001	.02	21	.001	32	33	.01	470	<.1	150	.08	.026	.03	16	.02	.05	<.01	33.0	1.0	11	35	.04
1478	7/20/81	6.2	<.001	.04	24	<.001	16	19	.04	186	<.1	53	.09	.007	.02	4.3	.02	.05	<.01	7.0	.5	5.7	<5	.06
Yo- 514	9/1/81	6.4	.005	.80	15	<.001	4.2	4.0	.03	24	<.1	13	3.0	.004	.07	.9	.02	.06	.01	.37	.3	2.5	2	.08

WISSAHICKON FORMATION

Ch-2408	7/20/81	6.5	.002	.02	66	.001	25	88	<.01	386	<.1	160	.17	.005	.02	24	.01	.05	.01	5.50	2.0	28	24	83
Ln-1412	7/20/81	5.9	<.001	.10	5	<.001	2.3	5.0	<.01	40	<.1	18	.04	.006	.01	1.7	.01	.05	<.01	2.40	.3	1.9	<5	.08
1413	12/11/80	5.5	<.005	.06	12	<.001	.2	10	<.01	44	<.1	<20	.05	<.005	.04	.3	<.01	.01	<.01	4.60	.6	10	<1	.04
1420	9/3/81	5.2	<.001	.10	5	<.001	.9	20	.03	114	.1	20	.11	.006	.09	2.0	.04	.07	<.01	6.40	.7	20	<5	.05
1422	8/3/81	5.6	<.001	.10	6	<.001	1.4	8.0	.01	88	<.1	<20	.08	.009	.04	1.9	.02	.19	<.01	3.50	.7	8.0	10	.10
1423	8/3/81	5.7	.001	.09	7	<.001	8.9	23	.01	474	<.1	63	.07	.011	.05	8.3	.03	.15	<.01	12.0	.9	12	10	2.2
1432	12/11/80	5.8	<.005	.04	9	<.001	.6	7.0	<.01	44	<.1	<20	<.01	<.005	<.01	.6	<.01	.10	<.01	3.40	.6	10	<1	<.01
1477	9/3/81	6.0	<.001	.10	14	<.001	10	11	.01	170	<.1	47	.06	.074	.15	5.3	.02	.06	<.01	13.0	1.0	11	<15	.03
Yo- 446	9/1/81	5.8	.005	.20	5	<.001	2.7	3.0	.01	46	<.1	24	.02	.005	.01	2.1	.01	.06	<.01	4.40	.4	3.5	<5	.04
478	8/25/81	5.4	<.001	3.7	4	<.001	5.1	12	.01	114	<.1	40	.42	.01	.08	6.8	.03	.02	<.01	9.20	1.0	2.5	<15	50
614	7/30/81	5.9	.001	.06	10	<.001	9.5	12	.01	136	<.1	51	.10	.001	.03	5.9	.03	.05	<.01	8.60	.7	3.0	<5	.03
628	8/27/81	6.3	<.001	.10	20	<.001	9.6	8	<.01	98	<.1	40	.05	.004	.05	3.8	.01	.05	<.01	2.90	2.0	4.2	10	.04
1050	8/3/81	6.9	.001	.10	74	<.001	23	4	<.01	138	<.1	78	.21	.003	.14	5.9	.01	.10	<.01	1.40	.5	4.4	4	.06

TABLE 19. (CONTINUED)

Well number	Date of collection	pH	Arsenic (As)	Aluminum (Al)	Alkalinity ($CaCO_3$)	Cadmium (Cd)	Calcium (Ca)	Chloride (Cl)	Chromium (Cr)	Dissolved solids	Fluoride (F)	Hardness ($CaCO_3$)	Iron (Fe)	Lead (Pb)	Manganese (Mn)	Magnesium (Mg)	Nickel (Ni)	NH_3, as N	NO_2, as N	NO_3, as N	Potassium (K)	Sodium (Na)	Sulfate (SO_4)	Zinc (Zn)
PIEDMONT UPLANDS SECTION (CONTINUED) WISSAHICKON FORMATION (CONTINUED)																								
Yo-1051	8/27/81	6.1	<.001	.06	24	<.001	9.6	10	<.01	118	<.1	40	.03	.006	.01	3.2	.01	.05	<.01	8.4	.5	7.6	<5	.03
1052	8/27/81	6.1	<.001	.05	9	<.001	6.9	14	<.01	142	<.1	34	.14	.005	.02	3.7	<.01	.05	.01	10.0	1.0	9.1	<5	.09
1053	8/3/81	6.0	<.001	.10	13	<.001	6.6	7	.01	120	<.1	26	.08	.008	.04	1.7	.01	.16	<.01	4.20	.4	4.5	10	.06
1054	8/3/81	5.8	.001	.10	8	.001	4.4	38	.01	224	<.1	47	.07	.004	.52	5.8	.03	.26	.04	11.0	6.0	19	5	.07
1057	8/25/81	5.2	.001	.08	3	<.001	3.3	12	<.01	70	<.1	25	.06	.012	.05	4.2	.03	.01	<.01	4.60	.7	4.2	<15	.02
1076	7/23/81	6.4	<.001	.04	18	<.001	3.8	3	.01	78	<.1	28	.22	.003	.02	3.2	.01	.01	<.01	1.80	.5	2.3	5	.04
1097	8/3/81	6.5	.001	.07	32	<.001	13	5	.01	126	<.1	44	.09	.004	.05	3.0	.02	.17	<.01	2.80	.5	2.5	8	.06
1102	7/30/81	5.9	.002	.10	12	<.001	9.9	21	<.01	192	<.1	61	.06	.009	.33	5.7	.01	.50	<.01	15.0	1.0	16	<5	.02
1108	8/25/81	5.8	<.001	.02	6	<.001	1.2	2	.02	36	<.1	20	.04	.005	.02	.7	.03	<.01	<.01	.04	.3	1.0	<5	.04
1111	8/3/81	5.8	.001	.08	8	<.001	6.0	11	.04	120	<.1	34	.05	.011	.01	4.0	.02	.19	<.01	7.70	.9	4.4	5	.04
1112	8/3/81	5.8	<.001	.10	9	<.001	15	13	.01	176	<.1	71	66	.006	.07	6.9	.02	.21	.01	9.00	.8	1.7	25	.04
1116	7/23/81	6.6	.001	.08	30	<.001	22	8.0	.07	152	<.1	78	.13	.005	.06	6.2	.07	.01	<.01	6.40	.5	2.5	22	.04
MARBURG SCHIST																								
Yo- 268	7/23/81	6.3	<.001	.10	18	<.001	19	13	.01	184	<.1	86	.05	.002	.01	5.5	.01	.01	<.01	9.00	.8	4.1	10	.04
1055	8/25/81	5.6	.001	.04	5	<.001	5.1	8.0	.01	86	.2	30	.06	.006	.03	4.1	.03	<.01	<.01	8.60	.9	6.6	<5	.05
1056	8/25/81	5.7	<.001	.03	7	<.001	4 6	12	.01	102	.1	34	.17	.006	.04	4.8	.03	.02	<.01	7.00	.9	6.2	<15	.56
1077	7/23/81	6.7	.001	.08	54	<.001	21	6.0	.01	126	<.1	64	.10	.004	.02	2.7	.02	.01	<.01	1.20	.5	3.2	7	.08
1078	8/27/81	6.1	.002	.08	7	<.001	3.3	4.0	<.01	44	<.1	<20	.02	.010	.02	1.7	.01	.05	.02	1.00	.3	1.0	<5	.02
GABBROIC GNEISS AND GABBRO																								
Ln-1487	8/31/81	7.6	.001	.03	96	<.001	46	9.8	<.01	262	<.1	140	.06	.002	17	6.9	---	.01	<.01	.10	5	4.8	35	.05

TABLE 20. RECORD OF WELLS

Well location: The number is that assigned to identify the well. It is prefixed by a two-letter abbreviation of the county. The lat-long is the coordinates, in degrees and minutes, of the southeast corner of a 1-minute quadrangle within which the well is located.

Use: C, commercial; D, dewater; H, domestic; I, irrigation; M, medicinal; N, industrial; P, public supply; R, recreation; S, stock; T, institution; U, unused, W, recharge; Z, other.

Topographic setting: F, flat; H, hilltop; S, hillside; T, terrace; V, valley flat; W, draw.

Aquifer: Qal, alluvium; Trh, Hammer Creek Formation; Trn, New Oxford Formation; Trs, Stockton Formation; Pl, Llewellyn Formation; Pp, Pottsville Group; Mmc, Mauch Chunk Formation; Mp, Pocono Formation; Dck, Catskill Formation; Dcb, Buddys Run Member; Dcd, Duncannon Member; Dcsc, Sherman Creek Member; Dciv, Irish Valley Member; Dccf, Clarks Ferry Member; Dtr, Trimmers Rock Formation; Dh, Hamilton Group; Dmh, Mahantango Formation; Dm, Marcellus Formation; Doo, Onondaga and Old Port Formations, undivided; DSkt, Keyser and Tonoloway Formations, undivided; Swc, Wills Creek Formation; Sb, Bloomsburg Formation; Sbm, Bloomsburg and Mifflintown Formations, undivided; Sc, Clinton Group; St, Tuscarora Formation; Oj, Juniata Formation; Obe, Bald Eagle Formation; Or, Reedsville Formation; Om, Martinsburg Formation; Ocn, Coburn Formation through Nealmont Formation, undivided; Obl, Benner Formation through Loysburg Formation, undivided; Oh, Hamburg sequence; Obf, Bellefonte Formation; Oa, Axemann Formation; Oe, Epler Formation, Os, Stonehenge Formation; OCc, Conestoga Formation; Cr, Richland Formation; Cm, Millbach Formation; Cbs, Buffalo Springs Formation; Czc, Zooks Corner Formation; Cl, Ledger Formation; Cv, Vintage Formation.

Lithology: cong, conglomerate; dol, dolomite; ls, limestone; sh, shale; ss, sandstone.

Static water level: Depth--F, flows but head is not known. Date--month/last two digits of year.

Reported yield: gal/min, gallons per minute.

Specific capacity: (gal/min)/ft, gallons per minute per foot of drawdown.

Hardness: gpg, grains per gallon.

Specific conductance: °C, degrees Celsius.

TABLE 20.

Well location								
Number	Lat-Long	Owner	Driller	Oate completed	Use	Alti-tude of land surface (feet)	Topo-graphic setting	Aquifer/ lithology
								BERKS
Be- 557	4009-7554	Caernarvon Twp. Munic. Auth.	Petersheim Bros.	9/52	M	750	S	Trs/---
560	4009-7554	do.	do.	9/54	N	780	5	Trs/---
561	4009-7554	do.	do.	9/52	M	775	5	Trs/---
562	4009-7554	do.	do.	9/63	N	752	S	Trs/---
								CENTRE
Ce- 30	4051-7741	Centre Hall Bor.	Harrisburg's Kohl Bros.	1916	P	1500	S	Obe/ss
31	4051-7741	do.	do.	1930	P	1415	S	Ocn/ls
54	4051-7734	5heffield Farms	C. I. Yarrison	---	N	1100	V	Ocn/ls
123	4052-7739	Centre Hall Bor.	Lester E. Gladfelter, Jr.	1959	P	1420	S	Or/sh
124	4052-7739	do.	do.	1959	P	1410	5	Or/sh
125	4051-7741	do.	R. 5. Carlin Inc.	1961	U	1510	5	Obe/ss
126	4051-7741	do.	do.	1961	U	1820	5	Oj/ss
127	4051-7741	do.	do.	1961	P	1860	S	Oj/sh
128	4051-7741	do.	Kohl Bros., Inc.	1962	P	1740	S	Oj/ss
130	4050-7741	do.	Oscar Oearmit	1965	P	1435	S	Or/sh
131	4050-7741	do.	do.	1965	U	1435	S	Or/sh
138	4054-7726	Aaronsburg Water Pipe Co.	---	---	P	1470	5	Obe/ss
139	4054-7726	do.	---	---	P	1320	5	Or/sh
140	4054-7726	do.	---	---	U	1320	S	Or/sh
181	4052-7739	Centre Hall Bor.	Harrisburg's Kohl Bros.	1968	U	1340	5	Ocn/ls
182	4051-7739	do.	do.	1969	U	1300	V	Ocn/ls
183	4052-773B	do.	do.	1969	U	1265	V	Ocn/ls
184	4052-7739	do.	do.	1969	U	1350	5	Ocn/ls
185	4051-7741	do.	R. S. Carlin Inc.	1964	P	1725	S	Oj/sh
187	4049-7728	Poe Valley St. Pk.	Russell R. Brooks	196B	W	1290	V	Or/sh
196	4049-7728	do.	Lester E. Gladfelter, Jr.	1953	H	1270	V	Or/sh
197	4049-7728	do.	do.	1959	H	1300	V	Or/sh
198	4049-7728	do.	do.	1953	H	1300	V	Or/sh
199	4049-7728	do.	do.	1953	H	1290	V	Or/sh
206	4051-7727	Penn Twp. Water Oist.	---	1965	P	1180	V	Obe/ss
208	4055-7726	Rebersburq Water Co.	Russell R. Brooks	1965	P	1480	5	Ocn/ls
220	4052-7738	Centre Hall Bor.	Harrisburg's Kohl Bros.	1969	U	1300	V	Obl/ls
232	4050-7364	Norse Paddle Co.	Gilbert R. Zechman	1977	N	1200	V	Obl/ls
242	4050-7733	A. Benton	Oscar Oearmit	1979	H	1090	V	Or/sh
243	4051-7732	M. Battaglia	Gilbert R. Zechman	1979	H	1245	5	Ocn/ls
244	4051-7731	R. Wender	Harry J. Long	1978	H	1205	5	Ocn/ls
245	4051-7733	M. Tice	Gilbert R. Zechman	1978	H	1125	S	Ocn/ls
246	4051-7733	H. Glasgow	do.	1978	H	1125	5	Ocn/ls
247	4051-7735	R. Gorman	do.	1979	H	1120	5	Obl/ls
248	4050-7737	Terry Rossman	do.	---	H	1200	5	Obl/ls
249	4048-7736	5. Wilson	Oscar Oearmit	1979	H	1235	5	Ocn/sh
250	4048-7737	Lundy	do.	1976	H	1180	V	Or/sh
251	4045-7737	Elsie Byler	do.	1977	H	1815	5	Oj/sh
252	4045-7736	Bruce Duqan	do.	1979	H	1690	S	Oj/ss
253	4050-7736	Norse Paddle Co.	Gilbert R. Zechman	1977	N	1180	F	Ocn/ls
254	4049-7734	H. Aukerman	Harry J. Long	1978	H	1190	V	Ocn/sh
276	4047-7741	Erskine Cash	Oscar Oearmit	1977	H	1355	H	Or/sh
277	4046-7740	J. Runkle	do.	1979	H	1250	S	Or/sh
278	4048-7739	Albert Outrow	Gilbert R. Zechman	1974	H	1160	V	Or/sh
279	4048-7739	S. Wilson	Oscar Dearmit	1979	H	1185	V	Or/sh
280	4047-7738	E. Johnson	do.	1978	H	1250	H	Or/---
281	4047-7738	J. Cole	Harry J. Long	1979	H	1265	H	Or/---
282	4046-7740	Nathan Long	Oscar Dearmit	1978	H	1310	H	Or/sh
283	4047-7740	J. Cole	do.	1977	H	1300	V	Or/sh
284	4047-7738	5. Wilson	do.	1979	H	1280	5	Ocn/sh
285	4047-7740	G. Ralston	do.	1979	H	1165	V	Or/sh
286	4048-7738	W. Tucker	do.	1978	H	1210	5	Ocn/sh
287	4049-7738	do.	do.	197B	H	1160	V	Ocn/sh
288	4049-7738	C. Fultz	Gilbert R. Zechman	1979	H	1200	V	Obl/ls
289	4050-7736	H. Breon	Oscar Dearmit	1979	H	1185	V	Ocn/ls
290	4051-7738	Ted Grove	Gilbert R. Zechman	1977	H	1320	H	Ocn/ls
291	4050-7742	Vern Coontz	do.	1974	H	1378	V	Obf/ls
293	4049-7740	Kevin Burd	do.	1979	H	1305	V	Ocn/---
294	4048-7741	Vinton Lingle	do.	1974	H	1322	V	Oa/---
350	4058-7717	Ralph Harbeck	do.	1977	H	1525	5	Or/---
365	4052-7734	Hoover Nall	Oscar Oearmit	1977	H	1350	5	Or/sh
366	4052-7733	C. Ilgen	Gilbert R. Zechman	1978	H	1215	V	Ocn/sh
367	4053-7730	R. Boop	do.	1978	H	1180	S	Obl/---
368	4053-7729	John Glasgow	do.	1977	H	1190	S	Obl/---
369	4054-7725	M. W. Vonada	Russell R. Brooks	1975	H	1150	5	Ocn/---
370	4051-7728	Barry Kauffman	Gilbert R. Zechman	1977	H	1210	5	Ocn/---
371	4054-7728	D. Grenoble	Oscar Dearmit	1979	H	1265	H	Oj/ss
372	4055-7728	Fred 5heets	Russell R. Brooks	1975	H	1250	H	Ocn/---
373	4053-7730	W. 5mith	Gilbert R. Zechman	1978	H	1165	V	Obl/---
374	4055-7730	N. Grove	do.	1978	H	1305	V	Obl/ls
375	4054-7723	N. J. Yoder	do.	1977	H	1145	V	Ocn/ls

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
COUNTY											
422	15	6	---	174	2/52	30	.31	1	---	6.2	Be- 557
500	88	8	---	55	7/54	40	.03	1	---	6.1	560
515	99	6	135;150;185;210	92	10/59	50	.82	1	---	6.3	561
390	122	6	340;355;372	105	8/63	78	1.3	3	---	7.5	562
COUNTY											
250	---	6	---	12	---	30	.25	---	---	---	Ce- 30
300	---	6	---	12	---	50	---	---	---	---	31
107	30	8	---	20	---	400	---	---	---	---	54
154	17	8	33;67;81;107	4	10/59	30	.22	---	---	---	123
150	31	8	37;83;113	6	10/59	30	.22	---	---	---	124
---	---	6	---	---	---	0	---	---	---	---	125
235	63	6	---	---	---	16	---	2	---	7.7	126
175	21	6	---	---	---	22	---	2	---	6.7	127
600	34	8	412	26	4/62	50	.22	3	---	6.5	128
231	20	6	30;48;80;171	---	---	180	---	---	---	---	130
278	37	6	48;60	20	---	110	---	11	---	7.7	131
160	50	6	---	40	---	15	---	---	---	---	138
310	90	8	---	---	---	18	---	---	---	---	139
---	---	6	---	---	---	10	---	---	---	---	140
300	110	6	220;235	160	11/68	2	.02	---	---	---	181
300	50	6	140;210	90	---	2	.01	---	---	---	182
338	74	6	160;235	160	1969	30	.17	---	---	---	183
350	80	6	220;260;320	150	9/69	7	.04	---	---	---	184
172	30	6	---	27	---	25	---	---	---	---	185
98	48	6	50;81;91	4	6/68	25	.98	---	---	---	187
72	53	6	54	16	5/53	10	.91	---	---	---	196
80	66	8	71;74	1	5/59	50	3.4	---	---	---	197
63	51	6	51;63	F	4/53	---	---	---	---	---	198
54	46	6	47	7	5/53	10	.59	---	---	---	199
128	15	6	---	15	1/65	80	---	---	---	---	206
350	72	6	---	23	8/65	60	.62	---	---	---	208
300	69	6	80;130	190	5/69	2	.02	---	---	---	220
201	130	6	148;196	70	5/77	30	---	---	---	---	232
190	21	6	185	---	1/79	4	---	---	---	---	242
276	119	6	202;245;269	157	8/80	20	---	19	480	---	243
119	15	6	75	35	7/78	1	---	---	---	---	244
151	40	6	44;48;120;144	40	11/78	10	---	---	---	---	245
301	60	6	160;235	---	11/78	3	---	---	---	---	246
201	40	6	74;190	58	8/80	35	---	12	390	7.48	247
351	130	6	299;347	132	6/77	6	---	---	---	---	248
75	40	6	70	---	1/79	12	---	---	---	---	249
65	20	6	---	11	8/80	60	---	10	350	---	250
115	22	6	110	---	8/77	6	---	---	---	---	251
210	51	6	200	42	8/80	3	---	4	155	8.01	252
201	130	6	148;196	99	8/80	30	---	---	---	---	253
45	24	6	14;27	---	10/78	18	---	---	---	---	254
165	20	6	160	---	9/77	30	---	7	320	7.6	276
125	20	6	115	---	7/79	5	---	---	---	---	277
251	42	6	100;230	25	8/74	4	---	11	820	---	278
125	20	6	115	36	10/80	5	---	---	---	---	279
85	20	6	80	56	10/80	30	---	20	820	---	280
107	20	6	27;103	40	3/79	24	---	---	---	---	281
350	40	6	345	---	6/78	15	---	---	---	---	282
145	40	6	140	48	10/80	30	---	7	295	---	283
207	42	6	197	51	10/80	15	---	12	395	7.2	284
45	30	6	40	---	1/79	70	---	---	---	---	285
100	40	6	95	43	10/80	20	---	17	680	---	286
65	20	6	60	5	10/80	20	---	---	---	---	287
197	153	6	162;178;195	27	4/79	30	---	---	---	---	288
165	114	6	160	110	10/80	40	---	18	630	---	289
351	42	6	322;335	199	10/80	7	---	---	---	---	290
326	60	6	97;280;320	160	10/80	5	---	13	430	7.4	291
375	61	6	440;462;365	115	7/75	10	---	---	---	---	293
224	61	6	115;184;213	100	1974	10	---	14	510	---	294
151	102	6	146	49	11/80	50	---	4	150	---	350
85	20	6	82	15	10/80	40	---	7	280	---	365
101	38	6	74;87	---	7/78	15	---	7	285	---	366
201	70	6	180;192	80	7/78	7	---	---	---	---	367
256	178	6	200;240	120	6/77	4	---	---	---	---	368
152	28	6	75;141;150	46	4/75	12	.11	---	---	---	369
201	42	6	120;170	150	10/77	5	---	---	---	---	370
210	50	6	205	---	3/79	20	---	---	---	---	371
101	48	6	62;84	39	11/80	20	.29	16	565	7.7	372
201	91	6	198	60	10/78	15	---	---	---	---	373
150	121	6	122;140	105	11/80	7	---	14	515	---	374
76	20	6	38;53;60	12	11/80	15	---	16	685	---	375

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
								DAUPHIN
Da- 20	4032-7654	Millersburg Home Water Co.	Rulon and Cook, Inc.	---	P	440	V	Mmc/sh
21	4032-7654	do.	do.	---	P	440	V	Mmc/sh
22	4032-7755	Millersburg Water Auth.	do.	1906	P	420	V	Mmc/---
31	4037-7647	Uniontown Water Co.	Shiffer Bros.	1930	P	620	V	Mmc/sh
45	4020-7654	J. C. Hoover Estate	Harrisburg's Kohl Bros.	---	H	350	V	Sc/---
379	4024-7639	S. J. Asper	do.	1954	H	490	H	Om/---
400	4032-7655	Millersburg Water Auth.	Kermit S. Snyder	1961	P	410	V	Mmc/sh
431	4029-7647	Girl Scouts of Am.	Harrisburg's Kohl Bros.	1962	T	798	S	Dcd/---
454	4031-7657	Berry Springs Water Co.	---	---	P	520	S	Mmc/---
577	4036-7642	Gratz Bor. Auth.	Kohl Bros., Inc.	1965	P	740	S	Mmc/---
585	4035-7637	Williamstown Bor. Auth.	---	1977	P	920	S	Mmc/---
592	4034-7634	Tower Auth.-Porter	Eichelberger Well Drilling, Inc.	1977	P	703	V	Mmc/ss
600	4033-7633	Koppenhaver	Paul T. Shiffer	1972	H	780	V	Mmc/---
601	4033-7633	Earl Romberger	do.	1974	H	800	V	Mmc/ss
602	4035-7636	Craig Solonce	Harrisburg's Kohl Bros.	1973	H	840	S	Mmc/sh
603	4034-7644	R. Sites	Paul T. Shiffer	1978	H	760	S	Mp/---
604	4034-7637	Amp, Inc.	Eichelberger Well Drilling, Inc.	1975	N	780	S	Mp/---
605	4034-7635	Williams Jr.-Sr. H. S.	Kohl Bros., Inc.	1969	P	760	V	Mmc/---
606	4036-7639	Harry Unger	Paul T. Shiffer	1972	H	700	S	Mmc/---
607	4036-7644	L. E. Hoffman	Fred C. Shiffer	1973	H	762	S	Mmc/---
608	4034-7638	Pa. Game Comm.	---	---	Z	760	S	Mmc/---
611	4023-7648	George Hetrick	Harrisburg's Kohl Bros.	1976	H	570	S	Dcsc/---
612	4023-7648	G. Shickley	Eichelberger Well Drilling, Inc.	1979	H	525	V	Dciv/---
613	4022-7649	Robert Shaw	Harrisburg's Kohl Bros.	1974	H	490	V	Dciv/sh
614	4023-7646	Armand Acri	do.	1975	H	590	H	Dciv/---
615	4023-7645	Jack Leibfried	do.	1975	H	710	S	Dtr/---
616	4022-7645	Leroy Weaver	do.	1973	H	580	V	Om/ss
617	4023-7644	I. Cartwright	William Lester Etnoyer	1973	H	770	S	Dh/ss
618	4023-7645	Paul Moore	Harrisburg's Kohl Bros.	1975	H	775	S	Dcsc/---
619	4023-7645	William Good	John Thran	1974	H	890	V	Sb/sh
620	4023-7651	L. Coulson	Eichelberger Well Drilling, Inc.	1979	H	440	S	Mmc/sh
621	4023-7652	Jane King	do.	1976	H	415	S	Mmc/ss
622	4028-7645	R. Miller	do.	1979	H	800	S	Dcsc/---
623	4028-7645	Roger Miller	Harrisburg's Kohl Bros.	1973	H	680	V	Dcsc/sh
624	4029-7642	Harry Kepler	do.	1979	H	830	S	Dcsc/ss
625	4027-7648	Stanley Miller	do.	1973	H	920	H	Dcsc/sh
626	4022-7655	Dauphin National Bk.	Eichelberger Well Drilling, Inc.	1980	T	502	H	Mmc/---
627	4022-7700	G. Chepolis	do.	1980	H	300	V	Mmc/---
628	4023-7657	E. Sweitzer	Paul T. Shiffer	1978	H	545	H	Mmc/---
629	4024-7654	L. Weller	do.	1978	H	490	S	Mmc/---
630	4026-7654	Timothy Shive	Eichelberger Well Drilling, Inc.	1979	H	530	H	Dcsc/ss
631	4026-7654	F. Strohecker	Fred C. Shiffer	1979	H	525	H	Dcsc/---
632	4025-7658	Paul Daniels	Harrisburg's Kohl Bros.	1980	H	490	S	Dciv/ss
633	4025-7658	Reed Twp.	do.	1980	---	550	H	Dciv/---
634	4027-7654	Accu-Mold	Eichelberger Well Drilling, Inc.	1980	H	690	S	Dcsc/---
635	4028-7655	Lexeen Inc.	Paul T. Shiffer	1978	N	395	V	Dciv/---
636	4030-7656	Clarence Miller	do.	1979	H	540	S	Dcd/---
637	4039-7656	Keister Constr.	do.	1979	C	390	V	Dtr/ls
638	4030-7658	Strohecker Mobile Home Pk.	Eichelberger Well Drilling, Inc.	1979	P	458	H	Dcd/sh
639	4029-7653	Mae Maurer	Paul T. Shiffer	1979	H	605	H	Dciv/ls
640	4031-7657	L. Koppenhaver	do.	1978	H	720	S	Mp/---
641	4033-7657	Jeff Messimer	do.	1979	H	535	V	Mmc/---
642	4035-7656	C. Schrader	do.	1978	H	420	S	Dcsc/---
643	4028-7652	Terry Kauffman	do.	1978	H	730	S	Dcsc/---
644	4034-7652	D. Hartman	Fred C. Shiffer	1980	H	550	S	Mmc/sh
645	4034-7654	Robert Troutman	Harrisburg's Kohl Bros.	1979	H	602	V	Mmc/---
646	4031-7651	M. Welch	John Thran	1979	H	870	S	Dcd/sh
647	4031-7651	L. Bowers	Fred C. Shiffer	1979	H	840	S	Dcd/---
648	4031-7652	J. Nice	Eichelberger Well Drilling, Inc.	1980	H	745	S	Dcsc/---
649	4029-7652	R. Farner	Paul T. Shiffer	1978	H	565	H	Dciv/---
650	4029-7652	Farner	do.	1975	H	578	S	Dcsc/---
651	4032-7649	F. Titus	do.	1978	H	710	S	Mmc/---
652	4033-7651	Roy Teter	Fred C. Shiffer	1979	H	578	S	Mmc/---
653	4033-7647	W. Leiter	Paul T. Shiffer	1978	H	662	V	Mmc/---
654	4033-7646	Paul Shiffer	do.	1979	H	565	V	Mmc/---
655	4034-7647	H. Bender	do.	1978	H	602	V	Mmc/---
656	4034-7645	Usuka	do.	1974	H	625	S	Mmc/---
657	4034-7646	Ben Crabb	do.	1972	H	580	S	Mmc/---
658	4035-7648	Steven Wise	do.	1979	H	662	V	Mmc/---
659	4035-7648	Gary Wise	do.	1974	H	638	S	Mmc/---
660	4036-7648	D. Engle	Fred C. Shiffer	1979	H	745	H	Mmc/---
661	4035-7649	G. Hostetter	do.	1979	H	682	S	Mmc/sh
662	4036-7648	G. Pellas	Paul T. Shiffer	1978	H	720	H	Mmc/---
663	4036-7648	C. Mattis	Fred C. Shiffer	1979	H	725	V	Mmc/---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
COUNTY											
300	---	8	---	F	9/31	50	---	---	---	---	Da- 20
500	---	8	300;500	F	9/31	150	2.4	---	---	---	21
300	---	8	---	20	---	85	.85	---	---	---	22
296	---	6	---	100	---	65	.36	---	---	---	31
140	---	6	---	14	6/31	5	.45	---	---	---	45
110	50	6	---	---	---	27	---	---	---	---	379
300	42	8	---	---	---	112	5.6	7	---	7.7	400
300	49	6	75;175;236	13	7/62	27	.12	---	---	---	431
270	94	6	---	---	---	55	.44	---	---	---	454
350	23	6	---	35	1/65	60	.87	---	---	---	577
250	---	6	---	---	---	70	---	25	---	5.9	585
175	---	---	65;96	22	5/77	30	.57	---	---	---	592
112	44	6	80;105	30	8/72	20	.18	---	---	---	600
125	110	6	50;80;110	25	3/74	20	---	1	65	5.8	601
100	60	6	---	30	4/73	10	.14	---	---	---	602
205	41	6	85;185	40	8/78	20	.12	---	---	---	603
600	90	8	98;147;233;477	7	5/81	56	.60	4	185	---	604
195	---	6	110;156;185	50	10/69	100	3	1	50	5.6	605
175	41	6	85	41	7/81	8	.07	7	400	6.2	606
80	21	---	75	20	6/73	11	2	---	---	---	607
---	---	---	---	19	7/81	25	---	2	80	6.0	608
260	42	6	55;140;258	22	8/76	12	.05	2	145	---	611
75	42	6	47;54	19	5/81	10	---	3	200	---	612
120	55	6	35;70	15	5/81	12	.13	2	102	---	613
160	40	6	63;95;140	50	5/75	8	.05	---	---	---	614
200	63	6	160;190	62	5/81	15	.14	3	90	---	615
150	80	6	100;140	20	8/73	40	.31	---	---	---	616
93	58	6	65;90	29	2/73	22	.34	5	240	---	617
280	60	6	90;180	60	10/75	7	.03	---	---	---	618
250	90	6	---	---	8/74	8	---	---	---	---	619
125	42	6	64;84;119	---	11/79	10	---	---	---	---	620
150	43	6	142	33	5/81	10	---	5	175	---	621
125	42	6	48;119	---	6/79	20	---	---	---	---	622
100	40	6	52;70	7	5/81	7	.10	3	170	---	623
140	36	6	55;125	50	6/79	4	.04	---	---	---	624
340	26	6	40;90	205	8/73	4	.03	---	---	---	625
125	50	6	62;99;111	25	4/81	20	---	5	197	7.1	626
100	42	6	82	19	4/80	18	---	6	295	5.3	627
310	41	6	280	25	4/81	7	.03	6	220	---	628
143	62	6	100;138	38	4/81	12	.12	5	195	6.1	629
200	55	6	172;183	---	6/79	35	---	4	185	---	630
113	42	6	90;110	47	4/81	9	.16	3	125	---	631
260	40	6	135;245	98	4/81	10	.06	6	292	---	632
240	41	6	80;225	96	4/81	12	.08	---	---	---	633
450	42	6	161;416;432	152	4/81	15	---	5	218	---	634
267	63	6	120;230;160	30	7/78	55	.24	---	---	---	635
225	60	6	90;140;200	48	7/79	20	.12	---	---	---	636
482	34	6	240;460	9	4/81	12	.03	5	200	---	637
175	68	6	94;117;146	---	10/79	12	---	5	195	---	638
143	59	6	90;140	40	7/79	30	.30	---	---	---	639
247	84	6	160;240	80	8/78	10	.06	---	---	---	640
205	40	6	120;200	38	7/79	15	.09	---	---	---	641
224	67	6	120;220	49	4/80	20	.11	2	95	---	642
354	42	6	220;340	70	11/78	6	.02	---	---	---	643
102	29	6	90;95;98	28	4/81	9	.18	7	319	---	644
180	50	6	90;160	50	8/79	12	.09	---	---	---	645
200	40	6	190	---	11/79	20	---	---	---	---	646
150	27	6	100;128;147	85	8/79	5	.10	---	---	---	647
250	43	6	133;179	92	5/81	20	---	3	105	---	648
225	62	6	140;220	46	5/81	30	.16	4	220	---	649
165	43	6	100;135	40	9/75	10	---	---	---	---	650
164	81	6	110;160	50	10/78	15	.14	---	---	---	651
111	43	6	90;107	30	10/79	9	.14	6	300	---	652
123	62	6	80;115	32	5/81	15	.19	6	210	---	653
180	61	6	175	35	11/79	30	.21	---	---	---	654
205	42	6	180	40	7/78	10	.06	---	---	---	655
172	33	6	110;160	75	5/81	20	---	---	---	---	656
155	33	6	90;140	35	11/72	25	---	---	---	---	657
218	49	6	---	50	5/81	10	.06	8	318	---	658
176	38	6	100;160	40	4/74	6	---	---	---	---	659
136	47	6	85;130	48	5/81	20	.33	5	240	---	660
80	20	6	50;75	30	5/81	25	.71	5	215	---	661
168	42	6	120;160	35	8/78	30	.23	---	---	---	662
130	103	6	125	65	8/79	20	.57	11	420	---	663

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Da- 664	4034-7649	O. Neagley	Paul T. Shiffer	1975	H	602	V	Mmc/---
665	4036-7646	George Ressler	do.	1978	H	705	S	Mmc/---
666	4036-7649	M. G. Henninger	Harrisburg's Kohl Bros.	1979	H	682	S	Mmc/---
667	4034-7652	Edward Strohecker	Paul T. Shiffer	1972	H	625	V	Mmc/---
668	4035-7650	Charles Troutman	do.	1972	H	702	H	Mmc/---
669	4037-7646	V. Gessner	Fred C. Shiffer	1979	H	665	H	Mmc/sh
670	4028-7651	Jeff Shertzer	Paul T. Shiffer	1979	H	938	S	Dcsc/sh
671	4039-7651	Thelma Stimley	Harrisburg's Kohl Bros.	1975	H	670	V	Dcsc/---
672	4039-7650	Paul Enders	Paul T. Shiffer	1978	H	760	S	Dcsc/---
673	4027-7652	Norman Houser	Harrisburg's Kohl Bros.	1974	H	720	S	Dcsc/---
674	4027-7650	Alfred Gusler	do.	1974	H	685	V	Dcsc/---
675	4027-7652	R. Thompson	Paul T. Shiffer	1975	H	640	S	Dcsc/---
676	4026-7650	Dennis Snyder	Harrisburg's Kohl Bros.	1975	H	601	S	Dcsc/---
677	4026-7651	Tim Snyder	do.	1976	H	645	S	Dcsc/---
678	4032-7649	Donald Shadle	Paul T. Shiffer	1973	H	630	S	Mmc/---
680	4033-7648	Robin Landscaping	do.	1973	H	620	H	Mmc/---
682	4037-7648	C. K. Moore	---	1981	H	685	W	Mmc/---
684	4035-7649	Fred Shiffer	Fred C. Shiffer	1974	H	730	H	Mmc/---
686	4034-7646	R. J. Rodichok	do.	1974	H	580	W	Mmc/---
688	4037-7647	Nevin Witmer	do.	1974	H	600	H	Mmc/---
690	4033-7652	E. R. Stroup, Jr.	do.	1975	H	600	S	Mmc/---
692	4033-7655	M. E. Weist	do.	1974	H	550	S	Mmc/---
694	4033-7654	A. J. Kitchen, Jr.	---	1974	H	540	H	Mmc/---
696	4033-7658	R. E. Spangler	Paul T. Shiffer	1974	H	550	S	Mmc/---
698	4022-7654	Central Pa. Rifle Club	Harrisburg's Kohl Bros.	1967	R	420	S	Mmc/---
700	4022-7653	Mark Hoffman	do.	1972	H	380	V	Mmc/---
702	4024-7653	Norman Knapp	do.	1971	H	500	S	Mmc/---
704	4024-7654	Lawrence Shields	do.	1974	H	440	S	Mmc/---
706	4024-7655	Luther Shearer	do.	1969	H	420	V	Mmc/---
708	4023-7656	Raymond Labree	do.	1973	H	480	S	Mmc/---
710	4023-7656	Larry Teter	John Thran	1974	H	440	S	Mmc/---
712	4023-7657	Robert Dunkle	Harrisburg's Kohl Bros.	1972	H	400	S	Mmc/---
714	4022-7658	Elwood Smith	do.	1971	H	465	H	Mmc/---
716	4023-7658	B. S. Seiloff	do.	1966	H	460	W	Mmc/---
718	4023-7659	Harry Snyder	do.	1971	H	540	S	Mmc/---
720	4033-7655	Leroy Chubb	Paul T. Shiffer	1972	H	550	S	Mmc/---
722	4034-7656	Larry Mech	do.	1975	H	616	S	Mmc/---
724	4033-7654	Kenneth Fry	Fred C. Shiffer	1974	H	535	S	Mmc/---
726	4033-7657	Dennis Schaffner	Paul T. Shiffer	1974	H	500	S	Mmc/---
728	4032-7653	Charles Chubb	do.	1973	H	598	S	Mmc/---
730	4033-7649	Russell Snyder	do.	1975	H	640	S	Mmc/---
732	4033-7648	North Penn Co.	do.	1974	N	540	S	Mmc/---
734	4033-7646	Randy Wetzel	do.	1975	H	660	H	Mmc/---
736	4035-7647	Melvin Henninger	do.	1972	H	610	S	Mmc/---
738	4034-7645	Woodrow Mattern	Fred C. Shiffer	1973	H	730	S	Mmc/---
740	4035-7649	Harold Spaght	Paul T. Shiffer	1972	H	660	W	Mmc/---
742	4036-7648	I. Streub	Robert L. Brosius	1968	H	725	H	Mmc/---
744	4037-7648	Thomas Pope	Paul T. Shiffer	1972	H	670	W	Mmc/---
746	4037-7647	Lester Welker	do.	1972	H	665	H	Mmc/---
748	4024-7639	Penn National Turf Club	Harrisburg's Kohl Bros.	---	P	500	S	Om/---
750	4023-7639	do.	do.	---	P	520	S	Om/---
752	4020-7643	Skyline Water Co.	---	---	P	540	H	Oh/---
754	4033-7645	Elizabethville Water Co.	---	---	P	610	S	Mmc/---
756	4033-7647	do.	---	1955	P	730	S	Mmc/---
758	4027-7655	Halifax Bor. Water Dept.	---	1931	P	540	S	Dcsc/---
760	4024-7656	do.	---	1962	P	740	S	Dcd/---
762	4027-7655	do.	Harrisburg's Kohl Bros.	1975	---	520	S	Dcsc/---
764	4024-7656	do.	Paul T. Shiffer	1982	P	740	S	Dcd/---
								JUNIATA
Ju- 48	4037-7700	Calvin Strauser	---	---	H	480	V	Dmh/---
51	4038-7703	O. W. Goodling	---	---	H	600	V	Dtr/---
319	4037-7704	M. Strausser	Fred C. Shiffer	1979	H	880	S	Dtr/ls
320	4039-7703	K. Goodling	do.	1978	H	900	H	Dtr/ls
321	4039-7702	G. Reichenbach	do.	1977	S	760	S	Dtr/ls
322	4038-7702	M. Messimer	do.	1978	H	810	H	Dtr/ls
323	4037-7700	John Watts	G. L. Stone	1977	H	500	V	Dmh/sh
325	4037-7701	G. Goodling	do.	1979	H	600	S	Dtr/---
354	4037-7700	C. Frymoyer	do.	1979	H	520	V	Dmh/---
								LANCASTER
Ln-1533	4009-7036	Elizabethtown Water Co.	---	---	P	500	H	Trn/---
1534	4009-7636	do.	---	---	P	460	S	Trn/---
1535	4008-7635	do.	---	---	P	480	S	Trn/---
1536	4010-7610	Ephrata Bor.	---	---	P	380	V	Trh/---
1537	4010-7610	do.	Eichelberger Well Drilling, Inc.	---	P	400	V	Trh/---
1538	4006-7632	Mt. Joy Bor. Water Auth.	---	---	P	360	V	Oe/---
1539	4006-7632	do.	---	---	P	360	V	Oe/---
1540	4000-7621	Millersville Munic. Water Auth.	---	---	P	360	V	OCc/---
1591	4004-7604	Alcorn Waterworks	---	---	P	510	S	Cv/---
1592	4004-7604	do.	---	---	P	510	S	Cv/---
1593	4009-7602	Terre Hill Bor.	Sensenig and Weaver	9/81	P	520	S	Trh/---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
280	50	6	140;260	83	5/81	20	---	---	---	---	Oa- 664
143	42	6	140	14	5/81	50	.45	6	320	---	665
140	84	6	---	40	9/79	20	.20	---	---	---	666
155	33	6	110;140	33	5/81	30	.25	5	205	---	667
155	32	6	110;140	30	5/81	15	---	---	---	---	668
114	46	6	85;94;112	35	12/79	12	.19	---	---	---	669
285	50	6	160;280	97	5/81	8	.04	3	105	---	670
140	63	6	95;130	45	11/75	7	---	---	---	---	671
265	60	6	160;260	94	5/81	12	.06	5	215	---	672
180	42	6	79;165	105	10/74	12	.16	2	75	---	673
260	40	6	75;155	48	5/81	20	.10	4	155	---	674
285	42	6	110;250;170	85	5/81	4	.02	6	250	---	675
120	40	6	60;80	60	8/75	20	.33	3	140	---	676
190	30	6	130;178	80	6/76	15	.14	---	---	---	677
113	26	6	70;100	8	8/81	20	.24	1	50	5.5	678
155	30	6	90;140	46	8/81	8	.07	5	280	7.6	680
247	61	6	---	28	8/81	8	---	3	180	6.1	682
102	51	6	85;98	64	8/81	12	.8	5	280	7.8	684
150	29	6	90;146	47	8/81	11	.11	5	300	7.1	686
110	25	6	82	46	8/81	20	.8	3	200	6.4	688
85	28	6	80	56	8/81	13	.6	6	290	7.8	690
97	25	6	50;76	32	8/81	13	.5	4	220	7.1	692
170	---	6	---	95	8/81	---	---	5	320	7.3	694
122	76	6	---	26	8/81	15	.2	3	140	7.7	696
100	42	6	60;90	25	9/81	40	.5	---	---	---	698
80	30	6	50;65	9	9/81	12	.2	5	260	6.9	700
160	30	6	65;148	88	12/71	4	.1	---	---	---	702
200	41	6	80;150	56	5/74	12	.1	---	---	---	704
200	40	6	100;180	40	10/69	10	.1	---	---	---	706
200	40	6	112;168	50	9/73	25	.2	---	---	---	708
150	43	6	---	---	---	15	---	---	---	---	710
340	60	6	100;180	160	9/72	2	.01	---	---	---	712
180	43	6	90;160	---	---	15	.1	---	---	---	714
202	23	6	84;194	70	7/66	4	.03	---	---	---	716
540	60	6	70;90	25	10/71	7	.1	---	---	---	718
253	23	6	120;240	---	---	20	.1	---	---	---	720
145	42	6	80;135	30	2/75	20	.2	---	---	---	722
87	26	6	80;84	30	4/75	4	.2	---	---	---	724
128	28	6	90;120	35	4/74	8	.1	---	---	---	726
145	41	6	87;137	40	5/73	20	.2	---	---	---	728
263	20	6	180	---	---	3	.01	---	---	---	730
185	24	6	85;175	30	8/74	30	.2	---	---	---	732
305	47	6	190;290	45	8/75	4	.02	---	---	---	734
155	52	6	90;140	30	12/72	35	.3	---	---	---	736
114	40	6	75;90	70	10/73	20	.8	---	---	---	738
108	25	6	60;95	---	---	9	.1	---	---	---	740
120	24	6	112	22	4/68	---	---	---	---	---	742
155	31	6	80;120	35	10/72	15	.1	---	---	---	744
285	19	6	100;175	60	10/72	30	.1	---	---	---	746
300	38	8	75;190	---	---	404	4.8	---	---	---	748
300	---	8	72;96;178	---	---	---	---	---	---	---	750
400	54	6	---	---	---	75	---	---	---	---	752
200	---	8	---	---	---	50	---	---	---	---	754
278	---	8	---	---	---	70	---	---	---	---	756
300	50	8	---	---	---	50	---	---	---	---	758
300	62	6	---	---	---	70	.58	---	---	---	760
390	37	12	135;385	---	---	73	.52	---	---	---	762
310	84	8	---	---	---	200	---	---	---	---	764
COUNTY											
42	15	6	---	---	---	5	---	---	---	---	Ju- 48
44	15	6	---	7	---	3	.14	---	---	---	51
235	41	6	100;195;230	132	5/80	3	.03	3	170	---	319
166	43	6	110;158	46	7/78	10	.10	4	190	---	320
235	41	6	175;228	50	9/77	5	.03	1	140	---	321
333	41	6	175;250;328	75	4/78	2	.01	4	220	---	322
248	40	6	160	30	5/77	3	---	---	---	---	323
398	43	6	160	95	5/80	2	---	---	---	---	325
173	42	6	110;160	60	8/79	40	---	4	200	---	354
COUNTY											
700	---	6	---	---	---	---	---	---	---	---	Ln-1533
275	---	6	---	---	---	50	---	---	---	---	1534
600	---	8	---	---	---	200	---	---	---	---	1535
206	---	---	---	---	---	---	---	---	---	---	1536
320	---	---	---	---	---	---	---	---	---	---	1537
272	---	10	---	---	---	600	---	---	---	---	1538
144	---	10	---	---	---	800	---	---	---	---	1539
220	---	8	---	---	---	---	---	---	---	---	1540
120	---	8	---	---	---	---	---	---	---	---	1591
120	---	8	---	---	---	---	---	---	---	---	1592
352	146	8	60;120;290;320	---	---	275	---	---	---	---	1593

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Ln-1594	4009-7617	Lititz Bor. Waterworks	---	9/68	P	360	V	Os/---
1595	4009-7617	do.	---	9/68	P	360	V	Trn/---
1596	4009-7611	Akron Bor.	Myers Bros. Drilling Contractors, Inc.	9/81	P	400	V	Trn/---
1597	4009-7611	do.	---	---	P	380	S	Trn/---
1598	4009-7611	do.	---	---	P	380	S	Trn/---
1599	4012-7607	E. Cocalico Twp. Auth.	---	---	P	420	S	Trh/---
1600	4012-7607	do.	---	---	P	500	S	Trh/---
1601	4013-7605	do.	---	---	P	480	S	Trh/---
1602	4004-7636	Rowenna Water Co.	---	---	P	320	S	Cv/---
1603	4007-7603	Blue Ball Water Auth.	---	---	P	480	S	Czc/---
1604	4004-7624	E. Hempfield Twp. Munic. Auth.	---	---	P	400	V	Czc/---
1605	4005-7624	do.	---	---	P	380	S	Czc/---
1606	4003-7624	do.	Myers Bros. Drilling Contractors, Inc.	9/79	P	420	S	Cl/---
1607	4005-7620	E. Petersburg Bor. Auth.	do.	9/75	P	340	S	Czc/---
1608	4003-7631	Marietta Gravity Water Co.	---	---	P	255	V	Cbs/---
1609	4003-7631	do.	---	---	P	255	V	Cbs/---
1610	4005-7611	Leola Water Auth.	---	---	P	400	V	Czc/---
1611	4005-7611	do.	Kohl Bros., Inc.	9/77	P	410	V	Czc/---
1612	4004-7611	do.	do.	9/79	P	380	V	Cl/---
1613	4005-7612	do.	Myers Bros. Drilling Contractors, Inc.	9/80	P	420	S	Czc/---
1614	4016-7606	W. Cocalico Auth.	---	---	P	480	S	Trh/---
1615	4007-7634	Rheems Water Co.	---	9/32	P	440	S	Trh/---
1616	4007-7634	do.	---	---	P	440	S	Trh/---
1617	4009-7624	Manheim Water Dept.	---	---	U	400	V	Oe/---
1618	4005-7606	Western Heights Water Auth.	---	---	P	520	S	Czc/---
1619	4005-7607	do.	---	---	P	520	S	Czc/---
1620	4005-7606	do.	---	---	P	520	S	Czc/---
1621	4010-7623	Northwestern Lancaster County Auth.	---	---	P	420	S	Oe/---
								LEBANON
Lb- 718	4031-7629	George Hoover	---	---	H	550	V	Dh/sh
1025	4021-7614	Richland Waterworks	---	1966	P	548	S	Cr/dol
1055	4016-7626	Quentin Water Co.	Kohl Bros., Inc.	1972	P	612	S	Cbs/---
1056	4029-7632	Union Chapel	Fisher's Well Drilling	1980	T	618	H	Dtr/---
1057	4028-7634	H. M. Boltz	Myers Bros. Drilling Contractors, Inc.	1978	H	675	S	Dcsc/---
1058	4028-7634	Harry Kapp	do.	1979	H	681	S	Dcsc/---
1059	4027-7635	F. L. Custer, Jr.	Rufus A. Light	---	H	740	S	Dtr/---
1068	4031-7631	Clair Wagner	Fisher's Well Drilling	1977	H	648	S	Dtr/---
1069	4031-7629	Warren Kessler	do.	1977	H	620	S	Dtr/---
1070	4031-7630	George Gundrum	do.	1977	H	625	S	Dcsc/---
1080	4029-7632	Swatara St. Pk.	Kohl Bros., Inc.	1978	W	482	V	Dtr/---
1102	4018-7630	Stoney Crest Estates	---	---	P	561	S	Cm/ls
1103	4018-7630	do.	---	---	P	559	S	Cm/ls
1104	4021-7627	W. Lebanon Water Co.	---	---	P	561	S	Dh/sh
1105	4020-7627	do.	---	1939	P	520	S	Dh/sh
1106	4017-7617	Heidelberg Twp. Munic. Auth.	Gill Enterprises, Inc.	1981	P	610	V	Trh/ss
1108	4021-7625	Leon Zimmerman	Myers Bros. Drilling Contractors, Inc.	1965	P	670	S	Dh/---
1109	4021-7625	do.	do.	1965	P	670	S	Dh/---
1110	4021-7625	do.	do.	1977	P	670	S	Dh/---
								NORTHUMBERLAND
Nu- 30	4051-7647	Sunbury Milk Prod. Co.	---	1910	N	440	T	Dh/---
32	4051-7646	Engee's Creamery	Straub	1923	N	440	V	Dh/sh
51	4038-7653	Dalmatia Water Co.	Harrisburg's Kohl Bros.	1925	P	585	S	Swc/ls
53	4037-7655	Susquehanna Stone Co.	Clarence Hoover	---	N	410	V	Dh/ss
57	4042-7650	Herndon Textile Co.	---	1912	N	440	S	Dciv/---
85	4048-7634	Monry	---	---	N	650	V	Mp/---
101	4047-7640	Trevorton Water Co.	---	---	P	780	V	Mmc/---
102	4047-7640	do.	---	---	P	1100	S	Mp/---
103	4047-7625	Mt. Carmel Water Co.	Blanchard	1908	P	1400	S	Pl/---
105	4046-7640	Trevorton H. S.	---	---	H	880	H	Mmc/---
201	4049-7631	Nick Mattucci	Alvin Swank & Son, Inc.	1979	H	910	S	Dcb/---
202	4049-7631	Terry Mill	do.	1979	H	820	S	Dcb/---
203	4049-7632	Florien Shalango	do.	1979	H	890	S	Dcb/---
204	4051-7634	Kermit Mench	---	1979	H	740	H	Dh/---
205	4046-7639	Gary Troutman	Paul T. Shiffer	1978	H	940	S	Mmc/---
215	4052-7641	W. Kreischer	Gilbert R. Zechman	1980	H	610	S	Dh/---
216	4052-7641	J. Roeder	Alvin Swank & Son, Inc.	1979	H	602	S	Dh/---
220	4042-7647	Mandata Poultry Co.	---	1949	N	520	V	Dciv/---
221	4042-7647	do.	---	1960	N	540	W	Dciv/---
222	4042-7647	do.	---	1960	N	515	V	Dciv/---
223	4042-7647	do.	---	1960	N	540	W	Dciv/---
224	4042-7647	do.	---	1962	N	650	S	Dciv/---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
80	15	12	---	---	---	---	---	---	---	---	Ln-1594
80	15	12	---	---	---	---	---	---	---	---	1595
330	144	8	178;190;240; 280	---	---	400	---	---	---	---	1596
435	---	8	---	---	---	---	---	---	---	---	1597
600	---	8	---	---	---	130	---	---	---	---	1598
190	---	8	---	---	---	---	---	---	---	---	1599
800	---	8	---	---	---	---	---	---	---	---	1600
280	---	6	---	---	---	---	---	---	---	---	1601
101	---	6	---	---	---	20	---	---	---	---	1602
300	---	---	---	---	---	---	---	---	---	---	1603
200	---	6	---	---	---	---	---	---	---	---	1604
250	---	8	---	---	---	---	---	---	---	---	1605
200	160	8	90;128;171; 198	---	---	400	---	---	---	---	1606
495	---	6	---	---	---	---	---	---	---	---	1607
133	118	8	---	---	---	350	---	---	---	---	1608
215	180	10	---	---	---	350	---	---	---	---	1609
400	---	6	---	---	---	---	---	---	---	---	1610
400	42	---	82;130;252	---	---	100	---	---	---	---	1611
220	71	6	82;121	---	---	200	---	---	---	---	1612
320	59	6	158;289;315	---	---	100	---	---	---	---	1613
300	---	8	---	---	---	---	---	---	---	---	1614
108	---	---	---	---	---	60	---	---	---	---	1615
382	---	---	---	---	---	60	---	---	---	---	1616
85	---	8	---	---	---	---	---	---	---	---	1617
165	---	8	---	---	---	---	---	---	---	---	1618
410	---	8	---	---	---	---	---	---	---	---	1619
165	---	8	---	---	---	---	---	---	---	---	1620
210	---	6	---	---	---	---	---	---	---	---	1621
COUNTY											
125	---	---	---	---	---	---	---	1	35	5.8	Lb- 718
123	74	8	---	67	10/81	80	---	---	---	---	1025
360	101	10	99;163;210	80	8/72	146	1.6	---	---	---	1055
161	82	6	109;121	---	---	8	---	---	---	---	1056
275	82	6	156;160	---	---	45	---	2	58	---	1057
250	82	6	165	---	---	3	---	---	---	---	1058
206	29	6	58;205	---	---	7	---	4	122	---	1059
301	63	6	105;287	---	---	6	---	---	---	---	1068
201	84	6	92;188	---	---	25	---	2	85	---	1069
141	42	5	115;134	---	---	20	---	---	---	---	1070
178	44	6	77;110;150	32	10/78	10	.07	2	67	---	1080
505	53	6	---	---	---	16	---	---	---	---	1102
500	---	6	---	---	---	15	---	---	---	---	1103
140	---	---	---	74	10/81	30	---	---	---	---	1104
417	139	6	---	---	---	70	---	---	---	---	1105
138	52	8	84;101;130	---	---	150	---	---	---	---	1106
302	63	6	---	53	10/65	15	1.5	---	---	---	1108
322	63	6	---	52	10/65	12	1.5	---	---	---	1109
600	102	6	215;271;340; 390	---	---	50	---	---	---	---	1110
COUNTY											
190	40	8	---	48	---	40	---	---	---	---	Nu- 30
190	25	6	---	50	---	75	---	17	---	---	32
130	30	8	---	F	---	10	.5	---	---	7.0	51
101	6	6	---	7	8/30	20	---	8	---	---	53
137	30	6	---	30	---	50	---	---	---	---	57
101	18	6	---	35	1930	20	.8	---	---	---	85
140	80	6	---	---	---	240	---	---	---	---	101
280	---	---	---	F	---	5	---	---	---	---	102
1176	490	8	---	---	---	---	---	---	---	---	103
190	54	8	---	---	---	40	2.7	---	---	---	105
175	85	6	43;135	37	4/81	12	---	---	---	---	201
150	63	6	---	31	4/81	35	---	3	125	---	202
150	67	6	---	28	4/81	30	---	---	---	---	203
200	43	6	155;185	---	6/79	20	---	6	250	7.6	204
174	85	6	80;160	31	5/81	25	.18	2	75	7.8	205
200	54	6	74;138;190	30	8/80	7	---	7	210	---	215
150	31	6	---	---	---	13	---	---	---	---	216
230	---	8	---	8	---	199	28	---	---	---	220
300	22	10	---	20	9/60	55	.30	---	---	---	221
301	19	10	---	118	9/60	43	.52	---	---	---	222
340	15	10	---	130	10/60	62	.78	---	---	---	223
550	32	8	---	175	4/62	93	3.7	---	---	---	224

TABLE 20.

Well location Number	Lat-Long	Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Nu- 225	4042-7647	Mandata Poultry Co	---	1963	N	620	S	Dciv/---
226	4043-7635	C. Rhenn	Paul T. Shiffer	1978	H	935	S	Ocb/---
227	4044-7630	Clair Tobias	Alvin Swank & Son, Inc.	1979	H	805	S	Mmc/---
228	4042-7647	Mandata Poultry Co.	---	1980	N	705	S	Dciv/---
229	4042-7647	do.	---	1980	N	745	H	Dciv/---
230	4049-7644	G. Pautsch	Gilbert R. Zechman	1977	H	720	H	Dh/ls
236	4050-7632	Forest Fire Control Station	Alvin Swank & Son, Inc.	1974	H	840	V	Dciv/---
238	4037-7655	R. Zerbe	Hubler Well Drilling Co.	1978	H	550	H	Otr/---
239	4039-7651	C. Maurer	Fred C. Shiffer	1980	H	635	S	DSkt/ls
240	4039-7652	Stone Valley Lutheran Parish	do.	1979	H	625	S	DSkt/ls
241	4038-7651	R. Zieders	Paul T. Shiffer	1978	H	680	S	Otr/sh
242	4038-7649	P. Yost	Fred C. Shiffer	1980	I	542	H	Dcsc/sh
243	4040-7651	M. Mattern	do.	1978	H	765	V	Ooo/ls
244	4040-7647	G. Wolfgang	do.	1979	H	910	S	Dh/ls
245	4042-7648	M. Percaskie	Gilbert R. Zechman	1980	H	699	S	Dciv/---
277	4050-7637	C. Kerstetter	Alvin Swank & Son, Inc.	1978	H	750	V	Dh/---
278	4049-7635	F. Jaroskie	Gilbert R. Zechman	1978	H	740	S	Ocb/sh
280	4051-7631	W. Swank	Alvin Swank & Son, Inc.	1978	H	1080	V	Dtr/---
281	4047-7636	Daniel Breining	William Becker	1967	H	890	V	Mmc/sh
285	4047-7636	Florence Schawlm	Robert L. Brosius	1967	H	960	S	Mmc/sh
287	4045-7633	Nevin Kerstetter	Roy Zimmerman	1968	H	1010	S	Mmc/ss
289	4045-7632	Charles Lenig	do.	1966	H	1000	S	Mmc/sh
								PERRY
Pe- 16	4018-7708	Minnie Ganister	---	---	H	680	W	Dh/---
23	4023-7701	Supplee-Wills-Jones Milk Co.	---	---	N	350	V	Dck/---
41	4027-7658	Edward Louden	Harrisburg's Kohl Bros.	1964	H	415	V	Dciv/---
44	4021-7659	C. J. Ellenberger	Shiffer Bros.	---	H	350	V	Mmc/sh
54	4019-7729	Luke Flickinger	---	---	S	685	V	Sbm/---
55	4021-7729	Stambaugh Bros.	---	---	S	860	S	DSkt/---
56	4018-7719	Miles Morrison	---	1931	H	685	S	Sbm/---
57*	4020-7718	Charles Burtnett	---	---	H	560	S	Swc/---
58	4020-7718	G. K. Morrison	---	---	H	575	S	Swc/sh
59	4021-7718	M. H. Yohn	---	---	H	710	W	DSkt/---
60*	4021-7718	Leroy Rice	---	---	H	650	S	Swc/sh
61	4022-7718	Greenpark Sch.	---	---	T	600	S	Swc/---
64*	4022-7720	Youth Development Ctr.	---	1924	T	580	V	Swc/---
65*	4023-7717	Sunnydale Farms, Inc.	G. R. Blosser	---	C	640	V	Swc/---
71	4022-7720	Youth Development Ctr.	---	1932	U	615	S	Swc/sh
72	4020-7720	Keystone Area B. S. A.	Harrisburg's Kohl Bros.	1959	T	620	S	Sc/---
73*	4021-7721	do.	do.	1962	T	630	H	Sbm/---
74	4021-7720	do.	do.	1951	T	560	H	Sc/---
75	4020-7732	Blain Munic. Waterworks	Hubler Well Drilling Co.	1953	P	800	W	DSkt/---
76	4020-7731	do.	do.	1961	P	800	W	Swc/---
77	4023-7701	Sunshine Hills Water Co.	---	---	P	510	S	Dciv/---
78	4025-7712	Bloomfield Bor. Water Auth.	---	---	P	765	W	Doo/---
82	4020-7711	Samuel Warner	Harrisburg's Kohl Bros.	1964	H	490	V	Dtr/---
83	4023-7720	Dr. Joseph Matunis	do.	1963	---	670	S	DSkt/---
84	4021-7720	Harry Britcher	do.	1964	H	560	S	Sc/---
85	4019-7703	Leo Hackenberger	do.	1964	H	580	S	Dcsc/---
86	4024-7713	Robert Sutch	do.	1964	H	730	S	Swc/---
88	4022-7711	Merwin Gibble	---	1960	H	575	W	Om/---
89*	4020-7717	C. E. Bolze	---	1961	H	570	V	DSkt/---
90	4020-7719	J. H. Barkley	Harrisburg's Kohl Bros.	1963	H	530	S	Swc/---
91	4023-7717	Robert Rohrer	Robert D. Roher	1964	H	720	S	Swc/---
92*	4020-7718	Glen Morrison	G. R. Blosser	1964	H	555	S	Swc/---
93	4021-7722	B. F. Lutz	do.	1964	H	575	V	Sbm/---
94	4019-7716	Charles Corral	do.	1964	H	540	V	Sbm/---
95*	4017-7716	William Barkley	do.	1964	H	680	S	Dcsc/---
96	4020-7718	Robert Lynn	do.	1964	H	550	S	Swc/---
98	4021-7720	Dave Trostle	do.	1964	H	580	V	Swc/---
99	4018-7720	Morse	do.	1964	H	680	V	Sbm/---
100	4018-7719	Aaron Morrison	do.	1964	H	705	S	Sbm/---
103	4024-7714	Mrs. M. Reader	do.	1964	H	795	S	Swc/sh
104*	4022-7719	Brinner	do.	1964	H	680	H	Swc/sh
105*	4020-7716	Robert Crozier	do.	1964	H	590	V	DSkt/---
106*	4020-7717	Lester Kell	do.	1964	H	570	V	Swc/sh
107	4020-7718	Annie Bell	do.	1963	H	565	S	Swc/---
108*	4022-7719	Loysville Printery	do.	1963	C	660	S	Swc/---
109	4022-7720	L. W. Shumaker	do.	1963	H	665	H	Swc/---
110	4020-7718	Paul Stum	do.	1963	H	535	S	Sbm/---
111	4021-7717	Karl Kling	do.	1963	H	675	V	Dcsc/---
112	4022-7720	Jim Barclay	do.	1963	H	615	W	DSkt/ls
113	4022-7721	O. A. Scott	do.	1963	H	590	V	Swc/sh
114	4022-7720	Ed Martin	do.	1963	H	580	V	Sbm/---
115*	4020-7718	Aaron Morrison	do.	1963	H	580	S	Swc/sh
116	4019-7721	W. S. Ramer	do.	1963	H	630	S	Sbm/---
117*	4020-7718	Edwin Bupp	do.	1963	U	580	S	Swc/sh

*Well is not shown on Plate 1.

(CONTINUED)

Total depth below land surface (feet)	Casing Depth (feet)	Casing Diameter (inches)	Depth(s) to water-bearing zone(s) (feet)	Static water level Depth below land surface (feet)	Static water level Date measured (mo/yr)	Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
550	40	8	---	137	5/63	100	---	---	---	---	Nu- 225
184	62	6	140;180	36	5/81	7	.05	3	95	---	226
175	43	6	85;118	---	6/79	20	---	3	130	---	227
595	---	7	---	---	---	45	---	---	---	---	228
320	---	7	---	---	---	100	---	---	---	---	229
401	56	6	150;211;396	60	2/77	12	---	---	---	---	230
250	41	8	73;221	---	---	12	---	---	---	---	236
295	21	6	185;275	195	8/78	10	1.0	---	---	---	238
50	30	6	38;45	16	5/81	30	1.5	15	590	---	239
114	38	6	60;110	79	5/81	6	.27	27	1230	---	240
163	63	6	150	40	5/81	20	.17	3	150	---	241
200	38	6	100;135;192	45	1/80	7	.05	---	---	---	242
85	62	6	68;74;80	40	8/78	14	.5	---	---	---	243
85	31	6	62;78	38	5/81	14	.37	4	170	---	244
200	40	6	50;62;198	27	5/81	8	---	6	275	---	245
200	40	6	---	---	---	8	---	---	---	---	277
200	---	6	65;87;106;120	40	10/78	12	---	3	160	7.8	278
300	50	6	---	---	---	3	---	2	90	7.7	280
80	40	6	65	17	12/81	20	4.0	5	240	5.2	281
120	42	6	105	35	4/67	15	---	---	---	---	285
130	55	6	90;124	---	---	20	---	---	---	---	287
95	60	6	90	---	---	9	---	4	240	6.1	289
COUNTY											
70	21	6	---	---	---	18	---	---	---	---	Pe- 16
330	---	6	---	---	---	40	---	7	---	---	23
84	51	6	58;80	42	---	12	---	---	---	---	41
76	22	6	---	10	---	---	---	---	---	---	44
52	7	6	---	---	---	12	---	---	---	---	54
150	17	6	---	---	---	1	---	---	---	---	55
86	45	6	---	20	1931	15	---	4	160	7.0	56
100	27	6	---	2	---	1	---	---	---	---	57*
112	67	6	---	20	---	12	---	16	590	7.5	58
128	90	6	---	90	---	.7	---	9	350	7.7	59
125	75	6	---	---	---	5	---	---	---	---	60*
61	45	6	---	20	---	20	---	10	380	7.8	61
102	21	6	---	6	5/65	100	5	---	---	---	64*
247	18	6	---	15	9/64	160	40	---	---	---	65*
308	38	6	---	21	---	50	---	20	---	---	71
178	36	6	---	60	8/59	20	.67	---	---	---	72
418	40	6	90;200	80	6/62	18	---	---	---	---	73*
169	5	6	---	20	1/51	20	.4	---	---	---	74
200	32	6	---	---	9/53	55	.6	---	---	7.7	75
135	40	6	---	---	1/61	40	.6	---	---	8.0	76
215	28	6	---	53	---	55	---	---	---	7.3	77
150	65	6	---	0	---	60	1.7	---	---	---	78
80	24	6	75	20	10/64	40	---	---	---	---	82
92	40	6	---	14	11/63	4	.18	20	670	7.1	83
226	27	6	41;83	10	9/64	2	---	4	270	7.6	84
120	37	6	96;112	35	6/64	8	---	---	---	---	85
125	36	6	40;115	35	5/64	8	---	---	---	---	86
65	41	6	20;65	12	9/60	36	---	---	---	---	88
144	82	6	20;40;140	0	11/61	24	1	---	---	---	89*
70	43	6	---	9	9/63	12	---	---	---	---	90
88	40	6	65	47	9/64	15	---	10	280	7.8	91
120	37	6	50;112	30	10/64	15	---	---	---	---	92*
100	37	6	---	10	12/64	25	---	---	---	---	93
65	45	6	40;60	15	11/64	7	---	5	180	6.9	94
116	25	6	58;112	31	8/64	15	---	---	---	---	95*
72	49	6	40;70	10	10/64	10	---	18	650	7.4	96
60	33	6	30;50	12	10/64	25	---	11	410	7.2	98
64	34	6	60	9	9/64	10	---	2	140	6.7	99
95	64	6	90	43	8/64	30	---	3	210	6.3	100
90	56	6	57;86	42	5/64	15	---	---	---	---	103
140	62	6	75;80;89; 135	100	5/64	15	---	10	250	7.6	104*
77	50	6	47;70	8	5/64	15	---	---	---	---	105*
85	79	6	42;60;70;80	---	4/64	---	---	---	---	---	106*
130	53	6	52;100	35	12/63	6	---	27	1075	7.3	107
132	57	6	87;125	80	11/63	12	---	---	---	---	108*
125	60	6	---	76	7/65	12	---	13	430	8.2	109
190	28	6	185	25	10/63	15	.20	5	270	7.9	110
50	15	6	12;30;45	0	6/65	15	2.2	3	190	6.3	111
40	24	6	10;35	6	10/63	15	---	---	---	---	112
80	35	6	65;75	19	7/65	10	.41	13	450	7.9	113
80	32	6	70	12	9/63	8	---	9	370	7.7	114
82	42	6	75	50	8/63	25	---	---	---	---	115*
95	39	6	85;95	22	7/65	10	.33	4	120	6.7	116
125	39	6	85;115	65	8/63	12	---	---	---	---	117*

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Pe- 118*	4020-7718	J. R. Shaffer	G. R. Blosser	1963	H	540	S	Swc/---
119	4020-7727	Donald Robbinson	do.	1963	H	685	V	Sbm/sh
120	4020-7714	Jim Wilt	do.	1963	H	600	S	Swc/sh
121*	4022-7718	W. W. Neely	do.	1963	H	590	V	Swc/---
122	4019-7716	Paul Crozer	do.	1963	H	545	S	Swc/---
123	4020-7717	William Fossleman	do.	1963	H	580	S	Sbm/---
124	4019-7716	William Barkley	do.	1963	H	560	S	Swc/---
125	4020-7714	J. E. Spotts	do.	1963	H	560	S	Swc/sh
126	4021-7728	David Harris	do.	1961	H	700	V	Swc/sh
127	4022-7719	Elwood Hench	do.	1961	H	675	S	Swc/---
128	4022-7718	John Hench	do.	1961	H	575	V	DSkt/ls
129	4019-7721	Rev. Johns	do.	1961	H	690	S	Swc/---
130	4021-7719	G. G. Wilson	do.	1961	H	565	V	Sbm/---
131	4020-7714	Jim Flanner	do.	1962	H	540	S	Swc/---
132	4021-7718	R. D. Linn	do.	1962	---	670	S	Swc/---
133	4019-7716	Harry Crozer	do.	1962	H	515	W	DSkt/---
134	4021-7719	Robert Ernest	do.	---	H	590	S	Sbm/---
136*	4020-7718	J. T. Patterson	do.	1962	H	565	S	Swc/---
138	4018-7716	William Barkley	do.	1962	H	670	S	Dcsc/---
139*	4020-7718	Florence Wertz	do.	1962	H	585	S	Swc/---
140	4021-7725	James Kuhn	do.	1962	H	620	V	Swc/---
142	4020-7725	C. N. Sheaffer	do.	1962	H	660	S	Sbm/---
143	4021-7717	Raymond Peck	do.	1960	H	640	S	Doo/---
144*	4021-7720	Joe Morrow	do.	1960	H	610	S	Swc/---
145	4020-7717	R. N. Wilt	do.	1960	H	565	V	Swc/sh
146	4020-7717	Carl Bolze	do.	1960	H	580	V	DSkt/ls
147	4018-7716	Naomi Womer	do.	1960	H	540	V	DSkt/---
148	4022-7720	Marvin Emlett	do.	1960	H	660	H	Swc/---
151*	4020-7718	Aaron Morrison	do.	1960	H	575	S	Swc/---
152	4020-7718	Mack Wilt	do.	1960	H	590	S	Swc/---
153	4020-7717	Frank Lyons	do.	1959	H	645	S	Swc/sh
154	4023-7717	S. L. Henry	do.	1959	H	730	S	DSkt/---
155	4019-7722	Don Lightner	do.	1959	H	700	S	Sbm/---
156	4020-7720	Neal Lightner	do.	1959	H	535	V	DSkt/---
157	4019-7727	John Harris	do.	1959	H	680	S	Sbm/---
158*	4020-7718	Donald Bender	do.	1959	H	550	S	Swc/sh
159	4023-7723	Harry Keller	do.	1959	H	750	S	Dh/---
161	4020-7718	Melvin Swegar	do.	1959	H	650	S	Swc/---
162	4021-7720	Joe Wilson	do.	1958	H	600	S	Swc/---
163*	4021-7720	Smily Briner	do.	1958	H	615	S	Swc/sh
164	4025-7725	Jacob Shuman	do.	1958	H	975	W	Sc/---
165	4022-7718	Edward Stambaugh	do.	1958	H	585	V	Swc/---
166	4021-7720	Marion Shaffer	do.	1958	H	550	V	Sc/---
167*	4022-7718	K. E. Kennedy	do.	1956	I	600	V	DSkt/---
168	4021-7721	Mary Kell	do.	1958	H	605	S	Sbm/---
170	4021-7720	Emlet Bros.	do.	1958	C	635	S	Swc/sh
171	4020-7718	Ed Nace	do.	1958	H	575	S	Swc/sh
172	4026-7723	Frank Minum	do.	1957	H	720	V	Sbm/---
173	4019-7726	Sam Baltosser	do.	1957	H	755	S	Sbm/---
174	4019-7725	Harold Irvine	do.	1957	H	660	V	Sbm/---
175	4020-7715	C. A. Shope	do.	1957	H	595	S	Swc/---
176	4023-7720	H. Fuller	do.	1957	H	785	V	Dcsc/---
177	4023-7717	Mrs. E. Reapsome	do.	1957	C	640	V	Swc/---
178	4023-7708	W. J. Jenkins	do.	1957	H	615	S	Dh/---
179	4020-7718	Ward Baughman	do.	1957	H	585	S	Swc/---
180	4021-7728	Dave Harris	do.	1957	---	700	V	Swc/---
181	4019-7716	Banks Schiebly	do.	1957	H	560	S	Sbm/---
182	4023-7716	C. E. Brytz	do.	1957	D	735	S	Doo/ls
183	4021-7725	Richard Johnson	do.	1957	H	620	V	Swc/---
184	4018-7718	David McAlicher	do.	1957	H	610	S	Sbm/---
185	4019-7716	Dean Shull	do.	1957	H	555	S	Swc/---
186*	4019-7721	Paul Kiner	do.	1957	H	690	S	Swc/---
188*	4020-7718	Aaron Morrison	do.	1956	H	580	S	DSkt/---
189*	4020-7718	R. J. Keffer	do.	1956	H	515	V	Sbm/---
190	4021-7725	Harris Garage	do.	1956	C	710	S	Swc/sh
191	4021-7718	Si Oum	do.	1956	H	605	S	Swc/---
192	4020-7715	Milt Bower	do.	1956	H	575	S	Swc/---
193	4021-7722	G. M. Clouse	do.	1956	H	580	V	Sbm/---
194	4019-7718	Carl Armstrong	do.	1956	H	585	W	Swc/---
195*	4020-7718	Aaron Morrison	do.	1956	H	580	S	DSkt/---
196	4018-7716	George Crozier	do.	1956	H	565	S	Doo/---
197	4020-7714	Elwood Comp	do.	1957	H	500	H	DSkt/---
198	4019-7716	Mt. Zion Ch.	do.	1956	T	590	H	Sbm/---
199	4019-7717	Karl Kennedy	do.	1956	H	530	S	Sbm/---
200	4021-7721	Dewey Baughman	do.	1956	H	555	V	Swc/---
202	4020-7718	G. R. Blosser	do.	1956	H	545	S	Swc/---
203	4020-7714	Elwood Comp	do.	1956	H	500	H	DSkt/---
204	4021-7724	J. C. Bishop	Hubler Well Drilling Co.	1961	H	610	W	Swc/---
205	4020-7718	Reformed Ch.	G. R. Blosser	1965	T	555	S	Swc/---
211	4018-7716	J. M. Sweger	do.	1965	H	615	S	Dcsc/---
219	4020-7718	M. W. Lightner	do.	1965	H	525	V	Sbm/---
221	4021-7720	Perry County Home	---	---	T	590	S	Swc/---
222	4021-7720	do.	---	---	U	575	W	Swc/---
223	4022-7722	C. I. Noss	John E. Hockenberry	---	H	605	V	DSkt/---

*Well is not shown on Plate 1.

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
200	38	6	43;195	21	7/63	15	.13	---	---	---	Pe- 118*
63	19	6	---	17	7/65	12	---	---	---	---	119
60	30	6	40;57	5	6/63	15	---	---	---	---	120
57	32	6	55	16	6/63	15	---	---	---	---	121*
75	23	6	40;70	15	5/63	25	---	---	---	---	122
194	44	6	65;190	40	5/63	15	.19	5	200	7.8	123
162	38	6	75;162	21	4/63	13	.16	5	210	7.0	124
60	39	6	8;57	8	---	25	---	15	650	7.1	125
51	31	6	25;38;40	10	7/65	30	---	15	550	---	126
131	61	6	125	95	11/61	20	---	8	310	7.7	127
51	19	6	45	12	10/61	30	---	---	---	---	128
152	131	6	---	27	6/61	15	.15	5	160	6.6	129
118	58	6	60;110	25	6/61	8	.09	7	280	7.9	130
96	44	6	65;80	60	3/65	6	.17	---	---	---	131
98	37	6	47;95	20	3/62	8	.11	---	---	---	132
43	20	6	22;32	16	4/62	25	6.3	17	630	7.2	133
101	---	6	---	---	5/62	10	---	8	310	6.6	134
87	27	6	85	30	5/62	15	---	---	---	---	136*
175	21	6	63;172	40	6/62	15	---	10	430	7.3	138
100	63	6	52;95	42	7/62	15	---	---	---	---	139*
62	20	6	20;60	4	7/62	12	---	19	710	---	140
114	108	6	98	40	8/62	25	---	6	225	---	142
120	64	6	40;64;115	30	8/60	25	---	---	---	---	143
76	63	6	74	53	7/60	15	---	---	---	---	144*
80	44	6	20;86	23	6/65	25	.69	9	320	7.7	145
75	50	6	65	16	6/65	8	2.2	13	470	7.2	146
51	27	6	35;48	9	5/60	30	---	8	300	7.5	147
100	55	6	96	60	5/60	20	1.3	8	265	7.5	148
90	38	6	30;50;85	22	1/60	6	---	---	---	---	151*
102	37	6	70;85	42	1/60	8	---	---	---	---	152
130	45	6	103;128	78	6/65	15	.31	13	550	7.6	153
130	100	6	79;128	65	8/59	15	---	---	---	---	154
98	40	6	70	37	7/59	2	---	1	70	7.4	155
62	38	6	58	19	7/59	15	.48	9	380	6.5	156
86	36	6	34;81	20	7/59	8	.12	4	215	---	157
72	50	6	37;70	13	6/59	8	---	---	---	---	158*
75	20	6	75	40	6/59	12	.4	5	310	---	159
160	82	6	92;130;150	60	5/59	6	---	17	510	7.6	161
95	52	6	55;90	37	10/58	15	.4	12	480	7.5	162
103	43	6	50;95	40	10/58	8	.16	---	---	---	163*
50	21	6	48	20	9/58	15	1.0	4	170	---	164
26	20	6	18	9	9/58	15	---	12	450	7.7	165
58	20	6	40;55	9	9/58	9	.22	6	250	6.7	166
80	38	6	40;75	22	9/56	15	---	---	---	---	167*
100	40	6	90	26	8/58	15	---	18	900	6.4	168
100	62	6	58;80;95	35	5/58	15	1.0	10	400	7.4	170
105	41	6	60;90	35	5/58	15	3	18	720	7.1	171
95	15	6	90	15	6/57	5	---	3	450	---	172
123	24	6	85	35	7/57	6	---	4	180	---	173
102	46	6	90	8	11/60	12	.17	3	160	---	174
70	53	6	55;65	40	7/57	10	---	---	---	---	175
53	21	6	30;50	18	7/57	10	---	2	150	5.3	176
57	20	6	55	6	8/57	20	.59	13	510	7.2	177
95	39	6	39	14	8/57	10	.14	---	---	---	178
109	68	6	65;100	28	8/57	15	.29	---	---	---	179
53	22	6	25;48	10	8/57	15	1.0	---	---	---	180
61	25	6	20;55	12	9/57	8	---	---	---	---	181
53	20	6	25;50	5	9/57	25	2.5	16	560	7.2	182
40	22	6	25;38	13	9/57	20	1.7	---	---	---	183
80	34	6	75	28	10/57	7	.22	4	170	7.2	184
89	35	6	---	45	11/57	15	3.0	7	290	7.4	185
120	115	6	30;80;115	15	11/57	20	---	---	---	---	186*
99	25	6	95	35	3/56	12	---	---	---	---	188*
70	17	6	40;65	10	4/56	12	---	---	---	---	189*
105	49	6	100	---	---	15	---	7	280	7.1	190
62	20	6	60	40	5/56	20	---	9	330	7.5	191
96	74	6	70	50	5/56	10	---	11	370	7.3	192
110	35	6	110	28	6/56	12	---	8	635	---	193
139	51	6	135	51	5/56	8	---	5	200	7.3	194
118	46	6	100	37	6/56	7	---	---	---	---	195*
98	71	6	90	40	9/56	12	.48	7	320	6.8	196
58	37	6	55	28	10/57	10	.83	---	---	---	197
80	31	6	---	37	10/56	15	---	4	180	6.5	198
50	22	6	---	12	10/56	15	---	8	300	6.4	199
65	36	6	34;63	12	11/56	15	---	7	280	7.8	200
112	35	6	100	20	9/66	15	.42	19	800	---	202
40	12	6	35	10	10/56	15	---	---	---	---	203
170	22	6	---	15	5/61	8	---	---	---	---	204
85	37	6	65	32	7/65	20	.79	13	550	7.4	205
70	40	6	45;65	24	6/65	15	.84	2	105	6.0	211
55	23	6	22;50	8	7/65	12	.68	5	210	6.9	219
64	---	---	---	---	---	---	---	15	450	7.4	221
124	21	4	---	15	7/65	20	.68	14	540	6.8	222
70	26	6	37;65	---	---	15	---	14	530	---	223

TABLE 20.

Well location: Number	Well location: Lat-Long	Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Pe- 225	4022-7725	Oscar Ricedorf	Harrisburg's Kohl Bros.	1958	H	830	S	Doo/---
226	4022-7725	John Milligan	do.	1963	H	865	S	Doo/---
227	4023-7724	R. B. Thrush	---	1960	H	685	S	Dh/---
228	4023-7726	Clair McMillan	Hubler Well Drilling Co.	1965	H	688	S	Doo/---
229	4022-7728	R. E. McMillen	do.	1963	H	765	V	DSkt/---
230	4024-7725	L. D. McMillen	do.	1963	H	723	V	DSkt/---
231	4023-7725	Theodore Latchford	Jack T. Walker	1963	H	700	W	Doo/---
232	4023-7725	Harry Latchford	do.	1963	H	720	W	Doo/---
233	4022-7724	Raymond Kint	Hubler Well Drilling Co.	---	H	670	V	Doo/---
238	4023-7726	Robert Wagner	do.	1965	C	675	V	Dh/---
239*	4023-7726	do.	do.	1965	H	675	V	Dh/---
249	4024-7716	John Stambaugh	Harrisburg's Kohl Bros.	1959	S	770	H	DSkt/---
251	4024-7715	Arthur Dum	---	1964	H	748	W	Swc/---
257	4022-7720	W. M. McGowan	---	1951	I	830	H	DSkt/---
300	4020-7717	William Barkley	G. R. Blosser	1965	H	570	S	Swc/---
342	4025-7711	Carson Long Inst.	---	1930	U	820	S	DSkt/---
343	4025-7711	do.	Harrisburg's Kohl Bros.	1939	T	740	S	DSkt/---
344	4025-7711	do.	do.	1959	T	780	S	Swc/---
345	4020-7718	Landisburg V. F. W.	---	---	H	580	S	Swc/---
346*	4020-7718	Landisburg Elem. Sch.	G. R. Blosser	1927	T	610	S	Swc/---
347*	4020-7718	do.	do.	1951	T	610	S	Swc/---
348	4022-7718	West Perry Jr.-Sr. H. S.	Ridpath and Potter Co.	1952	T	645	S	Swc/---
386	4023-7714	A. J. Foose	Harrisburg's Kohl Bros.	---	H	950	S	Dh/ss
388	4021-7730	J. L. Hummel	do.	1965	H	800	V	Swc/---
389*	4023-7717	Frank Hench	do.	1965	H	655	S	Swc/sh
390	4022-7724	Frank Dillman	do.	1964	H	765	V	Doo/---
391	4018-7716	Maryetta Bolze	do.	1964	H	555	S	Doo/---
392*	4020-7718	Tom Sweger	G. R. Blosser	1965	H	550	S	Swc/---
396	4020-7718	Neal Lightner	do.	1965	H	595	S	Swc/sh
399	4020-7714	Mary Anthony	do.	1965	H	535	V	Swc/---
400*	4030-7718	Don Bender	---	1965	H	540	S	Swc/---
402	4017-7714	Reisinger Bros.	Merle L. Gayman	1965	H	830	S	Doo/---
405	4021-7723	Blair Clark	G. R. Blosser	1966	H	600	V	Swc/---
406	4021-7719	Jay McCoy	Joe Cekovich	1966	S	560	S	Sbm/---
409	4019-7718	David Thompson	C. E. Sunday	1966	H	565	V	Sbm/---
410	4023-7726	Mrs. Grace Palm	Hubler Well Drilling Co.	1966	H	685	V	Dh/---
411	4023-7718	West Perry Sch. Dist.	Joe Cekovich	1966	T	675	S	Swc/---
412	4021-7717	Donald Lyons	G. R. Blosser	1966	H	665	S	St/---
413*	4022-7719	Kermit Binger	do.	1966	H	680	S	Swc/sh
418	4022-7728	H. L. Rice	Harrisburg's Kohl Bros.	1947	H	820	V	DSkt/---
419	4024-7726	George Lombard	---	1964	H	1155	H	St/---
420	4024-7726	Robert Gentzler	Joe Cekovich	1964	H	1155	H	St/---
421	4022-7716	K. Blumenschien	do.	1966	H	880	S	Dcsc/---
422	4019-7727	Ralph Yohn, Jr.	---	1966	H	690	V	Sbm/---
427	4022-7727	William Shuman	Hubler Well Drilling Co.	1966	H	740	V	Doo/ls
428	4023-7725	D. I. Hess	do.	1966	H	700	V	Dh/---
429	4019-7727	Smith Bros.	G. R. Blosser	1937	U	665	V	Sbm/---
430	4018-7719	James Elifritz	do.	1966	H	685	S	Sbm/---
431	4021-7720	Tressler Mem. Ch. parsonage	Harrisburg's Kohl Bros.	1966	H	593	S	Sbm/---
432	4020-7720	Shirley Schlosser	---	1966	H	720	S	Sbm/---
433	4020-7720	Charles Evitts	---	1966	H	735	S	Sbm/---
434	4019-7718	Mack Crull	G. R. Blosser	1966	P	580	S	Swc/---
436	4021-7715	Mrs. James Culbertson	do.	1955	H	833	W	Dh/---
437	4017-7716	Roy Foster	Harrisburg's Kohl Bros.	---	H	610	S	DSkt/---
438*	4021-7716	Walter Elman	G. R. Blosser	1935	H	873	S	Doo/---
441	4019-7729	Elsie Rowe	Hubler Well Drilling Co.	---	H	710	V	Sc/---
445*	4020-7718	John Scheaffer	G. R. Blosser	1966	H	550	S	Swc/---
449	4021-7716	Arthur Blumenschein	do.	1935	H	730	S	Dh/---
451	4018-7728	W. A. Shields	Harrisburg's Kohl Bros.	1964	H	845	S	Sbm/---
452	4020-7715	Alfred Albright	G. R. Blosser	1965	H	590	S	DSkt/---
453	4019-7722	Blant Bell	do.	1965	H	670	S	Sbm/---
454	4020-7720	Walter March	do.	1965	H	585	S	Sbm/---
455	4019-7721	J. D. Lightner	Merle L. Gayman	1964	H	700	S	Swc/---
456	4020-7719	H. A. Reifsnyder	Joe Cekovich	1966	H	515	V	Sbm/---
457	4020-7724	Glenn Gibble	---	1966	H	710	S	Sbm/---
459	4020-7718	S. E. Bell	---	---	U	565	S	Swc/---
460	4020-7718	J. M. Rice	---	---	H	575	S	Swc/---
461	4021-7721	G. W. Goodling	Hubler Well Drilling Co.	1959	H	610	S	Sbm/---
463	4024-7726	Harry Hartsough	---	1966	H	1130	S	St/---
466	4022-7719	Mildred Smith	Joe Cekovich	1967	---	632	V	Swc/---
505	4025-7710	Pa. Power & Light Co.	do.	1965	N N	678	V	DSkt/---
509	4027-7700	D. Mintz	---	1964	H	580	V	Dciv/---
521	4027-7658	L. S. Humphrey	Harrisburg's Kohl Bros.	1964	H	448	V	Dciv/---
524	4025-7709	William Ickes, Sr.	do.	---	H	653	S	Dtr/---
528	4027-7712	John Kreitzing	do.	---	H	800	H	Dciv/---
530	4019-7708	S. Gingrich	Gary L. Stone	1977	H	630	S	Dcsc/---
531	4018-7713	F. Sawyer	do.	1977	H	740	S	Dh/---
532	4018-7712	R. Barrick	Eichelberger Well Drilling, Inc.	1979	H	629	S	Dtr/sh
533	4017-7714	K. Pugh	do.	1977	H	852	S	Doo/sh

*Well is not shown on Plate 1.

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
155	95	6	60;94	58	1/58	4	---	7	270	---	Pe- 225
318	34	6	165;276;302	---	---	8	---	---	---	---	226
68	20	6	65	1	1960	30	---	1	100	---	227
80	---	6	---	---	---	---	---	17	740	7.0	228
80	18	6	18;55	8	10/63	50	---	6	255	7.4	229
170	20	6	150;165	10	7/65	22	.34	15	515	7.1	230
43	13	6	41	10	9/63	10	---	7	300	6.4	231
93	50	6	---	20	9/63	10	---	2	120	5.9	232
35	35	6	---	6	12/64	20	---	1	60	5.4	233
46	17	6	35	4	8/65	15	.56	10	370	6.9	238
61	20	6	---	3	8/65	8	---	---	---	---	239*
300	45	6	---	30	7/65	20	---	23	910	6.7	249
97	---	6	---	21	7/65	---	---	11	510	6.9	251
403	51	6	---	---	7/65	8	---	---	---	---	257
118	77	6	65;105	43	6/65	25	2	---	---	---	300
504	---	---	---	---	---	---	---	8	---	6.9	342
146	---	6	---	---	---	33	---	---	---	7.4	343
210	56	6	---	---	---	30	---	---	---	---	344
106	60	6	---	38	9/66	50	1.9	15	640	---	345
78	40	---	---	---	---	15	---	---	---	---	346*
232	45	6	---	60	9/51	30	---	---	---	---	347*
212	31	8	---	35	8/52	42	.36	---	---	7.6	348
100	42	6	---	25	10/64	30	---	---	---	---	386
120	44	6	70;160	45	8/65	15	---	---	---	---	388
160	44	6	10;44	30	---	16	---	---	---	---	389*
134	---	---	---	83	12/64	6	---	---	---	---	390
104	35	6	38;77	42	12/64	9	---	---	---	---	391
90	46	6	85	12	5/65	12	.2	---	---	---	392*
141	45	6	90;138	66	4/66	5	.44	17	650	7.1	396
85	41	6	45;80	23	9/65	20	---	---	---	---	399
70	38	6	36;60	18	9/65	20	---	---	---	---	400*
200	77	6	160;195	54	3/65	20	---	---	---	---	402
75	21	6	45;69	18	4/66	50	12	25	940	7.2	405
198	66	6	---	22	4/66	11	---	6	---	---	406
97	45	6	---	5	4/66	25	2.2	6	280	7.6	409
64	19	6	---	10	5/66	30	1.8	11	440	7.0	410
495	85	6	250	66	5/60	40	.17	9	360	---	411
70	54	6	65;70	35	---	12	---	---	---	---	412
141	68	6	90;130	86	6/66	15	1.9	8	360	7.6	413*
105	43	6	---	41	6/66	30	1.9	3	175	---	418
67	41	6	---	---	---	2	---	---	---	---	419*
122	22	6	---	60	1964	10	---	2	90	---	420
199	88	6	---	64	6/66	8	.25	1	100	---	421
78	37	6	40;65	11	6/66	25	1.3	4	210	---	422
47	21	6	40	15	6/66	25	31	6	260	7.8	427
63	30	6	---	23	6/66	10	.52	10	470	---	428
60	50	6	---	---	---	20	---	7	270	---	429
106	88	6	45;80;95	25	7/66	10	.2	---	---	---	430
223	27	6	71;190;213	35	8/66	20	.28	3	---	7.5	431
230	38	6	97;215	67	8/66	13	.2	5	---	7.6	432
204	22	6	41;192	57	8/66	8	---	---	---	---	433
130	102	6	52;80;97; 120	35	8/66	15	.3	---	---	---	434
137	70	6	---	---	---	15	---	---	---	---	436
90	---	---	---	---	---	---	---	6	345	---	437
100	40	6	---	---	---	7	---	---	---	---	438*
125	25	6	---	16	---	---	---	11	590	---	441
98	56	6	90	20	---	25	1.7	---	---	---	445*
75	22	6	---	---	---	5	---	---	---	---	449
60	45	6	---	30	10/64	3	---	---	---	---	451
80	50	6	40;55;70	22	9/65	15	---	12	430	---	452
85	66	6	50;70	35	12/65	8	---	---	---	---	453
69	50	6	67	---	11/65	10	---	---	---	---	454
122	90	6	120	62	6/64	20	---	1	50	---	455
123	23	6	---	6	6/66	---	---	3	---	---	456
70	59	6	---	23	7/66	60	7.7	1	40	---	457
18	---	36	---	5	10/66	---	---	12	560	---	459
22	---	40	---	9	10/66	---	---	21	1175	---	460
106	27	6	---	29	11/66	---	---	16	750	---	461
62	21	6	---	38	11/66	2	---	1	40	---	463
300	38	6	24;75;131; 215	22	7/67	34	.76	9	400	---	466
176	70	6	70;106;140; 158	40	12/65	40	1.5	---	---	---	505
95	35	6	70;90	24	---	9	---	---	---	---	509*
100	40	6	95	35	---	30	---	---	---	---	521
60	22	6	55	16	---	15	---	---	---	---	524
120	29	6	60;80	30	---	20	---	---	---	---	528
298	42	6	95;285	100	12/77	8	---	3	125	---	530
175	64	6	70;110;160	20	12/77	8	---	---	---	---	531
200	98	6	139;152	---	6/79	10	---	6	225	---	532
425	286	6	355	---	12/77	4	---	---	---	---	533

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Pe- 534	4017-7709	W. Bernhisel	Eichelberger Well Drilling, Inc.	1977	H	720	S	DSkt/ls
535	4017-7709	Vernon Kiner	Gary L. Stone	1976	H	768	S	DSkt/---
536	4019-7710	T. Close	do.	1978	H	452	V	Dcsc/---
537	4019-7711	E. Seiber	do.	1977	H	665	H	Dciv/sh
538	4018-7708	Harold Sierer	Eichelberger Well Drilling, Inc.	1977	H	593	S	Dciv/sh
539	4019-7710	Ed Arnold	Leon K. Sunday	1979	H	515	S	Dcsc/sh
540	4022-7708	Gary McBride	Eichelberger Well Drilling, Inc.	1977	H	555	S	Dtr/sh
541	4021-7701	D. Failor	C. E. Sunday	1978	H	492	S	Dciv/sh
542	4020-7712	James Johnston	Eichelberger Well Drilling, Inc.	1976	H	565	S	Dh/ss
543	4019-7713	Henry Curtis	do.	1977	H	600	S	Dtr/sh
544	4018-7734	Jeff Henry	Leon K. Sunday	1977	H	745	V	DSkt/---
545	4018-7734	H. E. Williams	Gary L. Stone	1977	H	745	V	Swc/---
546	4018-7735	R. Spahr	C. E. Sunday	1979	H	763	V	Swc/---
547	4018-7734	Charles Groff	do.	1977	H	765	V	Swc/sh
548	4016-7734	L. Scott	do.	1979	H	1030	H	Sc/sh
549	4018-7731	D. E. Rohm	Gary L. Stone	1978	H	840	S	Sbm/---
551	4023-7707	A. Lewis	Eichelberger Well Drilling, Inc.	1979	H	700	H	Dtr/sh
552	4024-7709	C. McGarry	do.	1979	H	645	V	Doo/sh
553	4025-7709	C. Aughenbaugh	Leon K. Sunday	1978	H	650	H	Dh/sh
554	4024-7709	P. Perkey, Jr.	Eichelberger Well Drilling, Inc.	1978	H	785	H	Dh/sh
555	4023-7711	R. Morrow	Leon K. Sunday	1979	H	700	V	Dh/sh
556	4023-7712	C. McKendrick	do.	1976	H	770	S	Dh/sh
557	4024-7714	David Weller	do.	1980	H	780	V	Dh/sh
558	4024-7712	Steven Sutch	do.	1978	H	735	V	DSkt/sh
563	4023-7713	R. Gordon	John Thran	1978	H	780	S	Dh/sh
568	4032-7659	Robert Wallis	Gary L. Stone	1977	S	400	V	Mmc/ss
571	4032-7700	C. White	do.	1978	H	555	S	Mmc/ss
574	4033-7703	Millard Sarver	do.	---	H	590	S	Dck/sh
575	4033-7700	John Hetrick	Leon K. Sunday	1979	H	520	V	Dck/sh
576	4019-7702	Sherwood Myers	Gary L. Stone	1977	H	599	V	Dcsc/---
577	4019-7702	T. Feltenberger	do.	---	H	570	H	Dciv/---
578	4021-7700	Paul Gilbert	do.	1978	H	597	S	Mmc/---
579	4021-7700	Richard Knepp	do.	1977	H	487	S	Mmc/---
580	4021-7700	H. M. Good	do.	1978	H	480	S	Mmc/---
581	4021-7700	T. Allandar	do.	1977	H	487	S	Mmc/---
582	4021-7701	Lamar Brouse	Eichelberger Well Drilling, Inc.	1978	H	468	S	Mmc/---
583	4019-7700	Fred Ziegler	Leon K. Sunday	1978	H	640	S	Dtr/---
584	4018-7701	John Davis, Jr.	Gary L. Stone	1979	H	770	S	Dtr/---
585	4019-7703	Lee Shumaker	Leon K. Sunday	1977	H	600	V	Dcsc/---
586	4021-7659	Leonard's Skate A Rama	Eichelberger Well Drilling, Inc.	1979	C	350	V	Mmc/---
587	4020-7657	P. Kerr	do.	1979	H	539	S	Dcsc/sh
588	4021-7659	Grace Steever	do.	1977	H	364	S	Mmc/---
589	4021-7658	A. R. Myers	Harrisburg's Kohl Bros.	1976	H	439	V	Mmc/---
590	4021-7700	J. Nevin White Lumber Co.	do.	1979	H	360	V	Mmc/---
591	4019-7658	Bob Zimmers	Eichelberger Well Drilling, Inc.	1976	H	500	S	Dcsc/---
592	4019-7706	Ron Wagner	Harrisburg's Kohl Bros.	1980	H	651	H	Dciv/---
593	4019-7706	Ronald Wagner	do.	1980	H	587	H	Dciv/---
594	4020-7657	Rod Lucas	do.	1977	H	710	S	Dcsc/---
595	4021-7658	Luther Byers	do.	1977	H	420	S	Mmc/---
596	4028-7657	Carl Lenig	Gary L. Stone	1976	H	542	H	Dciv/---
597	4023-7702	Ray Mullen, Jr.	---	1977	H	540	H	Dccf/sh
598	4023-7704	Ray Mullen, Sr.	Gary L. Stone	1976	H	490	S	Dccf/---
599	4023-7704	Luther Carnes	Leon K. Sunday	---	H	530	S	Dccf/sh
600	4024-7702	Joseph Lilley	Gary L. Stone	1977	H	570	S	Dciv/---
603	4023-7701	Duncannon Munic. Waterworks	---	1957	P	425	H	Dciv/---
604	4023-7701	do.	---	---	U	362	V	Dciv/---
605	4022-7702	do.	---	---	P	360	V	Dck/---
606	4033-7659	Liverpool Munic. Auth.	---	1968	U	410	W	Mp/---
607	4035-7658	do.	Harrisburg's Kohl Bros.	1973	P	418	S	Dck/---
608	4034-7659	do.	do.	1949	U	390	V	Dck/---
609	4034-7659	do.	do.	1979	U	540	H	Dck/---
611	4027-7706	K. Darr	Leon K. Sunday	1978	H	773	S	DSkt/---
614	4027-7601	V. Bostdorf	Joe Cekovich	1979	H	470	V	Dcsc/---
615	4028-7657	Jeff Miller	Gary L. Stone	1977	H	538	S	Dciv/---
625	4019-7658	Richard Albright	Leon K. Sunday	1977	H	565	H	Dcsc/---
626	4027-7659	R. P. Gilius	Gary L. Stone	1979	H	622	H	Dciv/---
627	4027-7659	Ed Dieter	do.	1977	H	540	S	Dciv/---
628	4027-7659	Joseph Falduts	do.	1976	H	565	H	Dciv/sh
629	4027-7658	Charles Downs	Joe Cekovich	1977	H	535	S	Dciv/---
632	4033-7702	Randell Martin	Gary L. Stone	1976	H	500	V	Dck/---
633	4025-7709	B. Owens	Leon K. Sunday	1978	H	650	V	DSkt/ls
639	4036-7759	Jeffrey Maus	do.	1975	H	720	S	Dtr/sh
643	4025-7709	Hare	do.	1980	H	640	S	Dh/sh
644	4025-7711	Barkley	do.	1977	H	860	S	Doo/ls

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
155	148	6	155	72	5/80	45	---	8	260	---	Pe- 534
195	156	6	185	80	4/76	12	---	---	---	---	535
148	21	6	90;130	1	4/78	15	---	3	175	---	536
148	41	6	110;135	25	5/80	15	---	---	---	---	537
150	90	6	122;146	28	5/80	30	---	4	155	---	538
275	60	6	85;270	72	5/80	20	---	5	230	---	539
225	42	6	215	39	5/80	12	---	---	---	---	540
217	58	6	80;170	---	6/78	7	---	---	---	---	541
225	40	6	67;91	2	5/80	50	---	6	250	---	542
125	42	6	115	33	5/80	15	---	2	185	---	543
95	33	6	90	5	4/77	15	---	12	460	---	544
73	69	6	70	20	9/77	80	---	---	---	---	545
205	33	6	90;150	---	7/79	5	---	---	---	---	546
63	40	6	30	6	5/80	12	---	12	480	---	547
245	40	6	150;235	---	4/79	12	---	7	265	---	548
298	41	6	180;275	12	5/80	4	---	2	540	---	549
275	66	6	205;256	---	8/79	3	---	2	87	---	551
200	81	6	150	---	7/79	35	---	---	---	---	552
220	53	6	110;210	61	5/80	15	---	3	134	---	553
500	43	6	85;388	50	5/80	4	---	4	185	---	554
160	41	6	80;150	0	5/80	20	---	---	---	---	555
90	60	6	70;85	30	8/76	20	---	---	---	---	556
300	80	6	270;290	32	5/80	20	---	14	513	---	557
236	40	6	90;160;230	35	9/78	50	---	---	---	---	558
100	80	6	90	20	5/80	30	---	2	55	---	563
173	42	6	150	21	5/80	50	---	6	280	---	568
323	43	6	140;300	65	1/78	6	---	1	257	---	571
148	42	6	110;130;140	35	9/77	50	---	4	190	---	574
235	40	6	195;225	90	4/79	12	---	3	160	---	575
248	42	6	150;230	40	10/77	12	---	4	225	---	576
148	40	6	130	51	5/80	9	---	2	89	---	577
98	41	6	50;90	12	4/78	8	---	3	107	---	578
147	40	6	120	15	4/77	15	---	3	123	---	579
298	60	6	140	25	7/78	2	---	4	175	---	580
88	42	6	80	25	5/77	6	---	2	83	---	581
350	41	6	119;217;236	32	5/80	8	---	5	202	---	582
140	60	6	80;120	69	5/80	20	---	1	50	---	583
198	100	6	180;190	74	5/80	12	---	3	133	---	584
135	60	6	95;125	30	6/77	30	---	3	137	---	585
150	6	6	106;127	5	5/80	20	---	8	285	---	586
175	43	6	161	90	5/80	8	---	2	105	---	587
100	42	6	87;92	---	7/77	25	---	3	116	---	588
100	51	6	75;90	25	5/80	10	---	2	90	---	589
140	50	6	80;118	27	5/80	20	---	---	---	---	590
150	42	6	118;121	---	8/76	8	---	3	153	---	591
160	40	6	90;145	49	5/80	10	---	3	158	---	592
155	40	6	80;145	48	5/80	30	---	---	---	---	593
400	42	6	125;175	46	5/80	3	---	3	127	---	594
100	38	6	18;60;85	18	5/80	20	---	---	---	---	595
98	44	6	60;80;90	23	5/80	15	---	3	185	---	596
123	42	6	80;110	35	8/77	12	---	5	203	---	597
148	42	6	80;110	40	5/80	20	---	5	200	---	598
120	41	6	60;110	24	5/80	20	---	5	206	---	599
148	42	6	---	35	7/77	12	---	1	55	---	600
250	---	8	---	175	---	50	1.4	---	---	---	603
317	---	6	---	25	2/65	80	1.0	---	---	---	604
500	65	6	95;136;344; 360	32	---	50	.54	---	---	---	605
350	52	8	---	30	2/68	118	.45	---	---	---	606
300	42	6	80;140	10	12/73	66	.31	---	---	---	607
100	19	6	---	15	1949	13	---	---	---	---	608
400	37	6	298	105	---	20	.07	---	---	---	609
200	102	6	120;150;170	60	6/78	10	---	---	---	---	611
152	40	6	102;140	25	8/79	20	---	---	---	---	614
123	40	6	110	28	5/80	40	---	5	268	---	615
205	42	6	170;205	60	11/77	50	---	3	133	---	625
173	40	6	135;155	35	5/80	20	---	---	---	---	626
148	45	6	80;90;125	50	8/77	10	---	3	177	---	627
148	40	6	80;130	18	5/80	18	---	---	---	---	628
176	40	6	120;158	51	5/80	14	---	4	183	---	629
148	42	6	70;130	15	5/76	20	---	---	---	---	632
475	60	6	110;470	45	12/78	4	---	---	---	---	633
195	45	6	80;150	80	7/75	5	---	---	---	---	639
140	60	6	115;130	30	4/80	30	---	---	---	---	643
500	105	6	460	100	8/77	5	---	8	350	---	644

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Pe- 646	4025-7702	John Shiffer, III	Gary L. Stone	1977	H	563	H	Ociv/---
647	4025-7703	P. Minsker	Harrisburg's Kohl Bros.	1977	H	562	S	Otr/---
652	4023-7702	E. Bradley	Joe Cekovich	1979	H	575	H	Ociv/---
653	4023-7703	B. Auxt	Eichelberger Well Drilling, Inc.	1979	H	485	H	Ociv/---
654	4022-7703	Chuck Rhodes	Leon K. Sunday	1978	H	532	S	Ociv/---
655	4024-7705	Dale Murphy	Gary L. Stone	1977	H	702	H	Otr/---
656	4024-7702	Ken Lint	Harrisburg's Kohl Bros.	1976	H	537	H	Ociv/---
657	4024-7704	R. Berger	Leon K. Sunday	1977	H	603	H	Otr/sh
658	4024-7705	R. Finkenbinder	Eichelberger Well Drilling, Inc.	1978	H	615	S	Otr/---
659	4023-7705	David Lehman	C. E. Sunday	1978	H	610	S	Otr/---
660	4026-7706	R. Miller	Eichelberger Well Drilling, Inc.	1978	H	690	S	OSkt/---
661	4024-7701	Sunshine Hills Water Co.	---	---	P	510	H	Ociv/---
662	4027-7708	Newport Bor. Water Auth.	---	---	P	410	W	Oh/---
670	4036-7701	M. Willson	Gary L. Stone	1979	S	740	S	Oh/---
								SCHUYLKILL
Sc- 7	4046-7613	Mountain City Water Co.	Kohl Bros., Inc.	---	P	1420	S	Mmc/---
8	4046-7614	do.	---	1912	P	1415	S	Mmc/---
9	4047-7614	do.	Blanchard	1915	P	1460	S	Mmc/---
10	4047-7614	do.	---	1912	P	1460	S	Mmc/---
11	4047-7614	do.	Blanchard	1904	P	1460	S	Mmc/---
12	4050-7611	Shenandoah Citizens Water and Gas Co.	---	---	P	1560	V	Pp/---
13	4050-7611	do.	---	---	P	1620	S	Pp/---
19	4048-7607	German Cemetery	---	1930	---	1700	S	Pp/---
20	4050-7606	Wyoming Valley Water Co.	---	1910	P	1800	S	Pp/---
21	4050-7606	do.	---	---	P	1740	W	Pp/---
47	4033-7614	Ed Banning	Ebbling & Binner	1915	H	710	V	Oh/---
82	4033-7615	F. Kirschener	do.	1924	H	670	S	Oh/---
83	4034-7616	J. A. Freeman	do.	1924	W	660	S	Ociv/---
84	4034-7624	George Lehman	do.	1924	H	575	V	Ocsc/---
85	4034-7622	Elias Kimtzel	E. J. Myers & Sons	---	H	580	V	Otr/ss
86	4034-7623	Ed Britz	Ebbling & Binner	1924	H	580	S	Oh/---
87	4033-7622	Pa. Power & Light Co.	---	---	P	560	S	Oh/---
89	4031-7622	H. Schnoke	Ebbling & Binner	1928	H	600	S	Oh/---
90	4031-7623	Elias Hope	do.	---	H	540	V	Oh/---
93	4031-7628	George Doubert	do.	1924	H	480	V	Oh/---
94	4034-7615	H. A. Herring	do.	1920	H	800	S	Ociv/---
99	4039-7628	Harvey Reed	---	---	H	880	V	Mmc/---
116	4035-7630	Garvin Bixler	---	---	H	760	V	Mmc/---
122	4038-7633	Mr. Schwahn	---	---	H	700	V	Mmc/---
124	4038-7635	Francis Matten	---	---	H	700	V	Mmc/---
127	4039-7641	Samuel Reed	---	---	H	520	V	Ocb/---
128	4042-7631	Herb Felix	---	---	H	940	S	Ocb/---
152	4046-7619	M. L. Miller	Kohl Bros., Inc.	1931	H	1040	S	Mmc/---
153	4046-7619	Ashland St. Hosp.	do.	1931	T	1000	S	Mmc/---
156	4046-7618	Immaculate Heart Acad.	do.	1925	T	1080	H	Mmc/---
174	4047-7615	Fetter's Dairy	do.	1928	N	960	V	Pl/---
224	4036-7623	Mary Mease	---	---	H	678	V	Mmc/---
225	4033-7619	John Hess	---	1955	H	770	H	Otr/---
226	4033-7619	G. A. Shadle	---	---	H	785	H	Otr/---
227	4036-7618	E. H. Bretz	Kermit S. Snyder	1960	H	680	S	Ock/---
228	4032-7628	Amos Kutz	---	---	H	580	S	Ock/---
229	4031-7623	Harold Wambaugh	David Deaven	---	H	630	V	Sb/---
231	4038-7624	Lester Tobias	John Mayernick	---	H	860	V	Pl/---
232	4038-7624	C. A. Wetzel	---	---	H	900	V	Pl/---
259	4046-7613	Metrapolitan Mirror Co.	---	---	N	1480	H	Pp/---
280	4053-7601	Honeybrook Water Co.	---	---	P	1740	V	Mmc/---
281	4053-7600	do.	---	---	P	1740	V	Mmc/---
282	4053-7600	do.	---	---	P	1740	V	Mmc/---
286	4038-7631	Hegins Twp. Auth.	---	1950	P	720	S	Mmc/---
287	4038-7629	do.	Kohl Bros., Inc.	1962	P	740	V	Mmc/---
323	4038-7631	do.	---	1967	P	780	S	Mmc/---
326	4035-7632	Tower City Bor. Auth.	Kohl Bros., Inc.	1967	P	930	S	Mmc/---
327	4035-7631	do.	do.	1964	P	935	S	Mmc/---
328	4035-7631	do.	do.	1964	P	760	V	Mmc/---
330	4047-7614	Pa. Dept. of Environmental Resources	---	1974	U	1130	V	Pl/---
331	4047-7614	do.	---	1974	U	1130	V	Pl/---
335	4046-7615	Ashland Bor.	---	1980	U	1460	W	Mmc/---
337	4045-7618	W. G. Price	Alvin Swank & Son, Inc.	1978	H	1040	S	Mmc/---
339	4046-7617	Malcolm Boyer	William W. Reichart	1968	H	1080	H	Mmc/---
341	4046-7616	G. H. Watkins	---	1980	R	1120	W	Mmc/---
343	4046-7617	James Samelko	Alvin Swank & Son, Inc.	1978	H	1080	H	Mmc/---
345	4046-7617	R. Wetzel	---	1879	H	1040	W	Mmc/---
347	4045-7619	Ellis Paul	Kohl Bros., Inc.	1977	H	1070	H	Mmc/---
349	4046-7619	Anthony Baran	Kermit S. Snyder	1977	H	950	W	Mmc/---
351	4046-7619	Joseph Baran	do.	1981	H	920	S	Mmc/---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25 C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
224	42	6	160;220	35	7/77	9	---	2	96	---	Pe- 646
200	42	6	105;185	80	5/80	6	---	4	210	---	647
528	40	6	---	85	6/79	25	---	5	265	---	652
150	42	6	137	---	4/79	20	---	5	---	---	653
260	40	6	150;250	74	5/80	15	---	4	---	---	654
248	63	6	210;240	80	6/77	25	---	4	---	---	655
160	60	6	120;140	60	9/76	20	---	---	---	---	656
115	40	6	80;95	40	12/77	15	---	---	---	---	657
300	40	6	211;286	---	4/78	4	---	4	188	---	658
125	42	6	80;90;100	5	5/80	20	---	4	193	---	659
125	81	6	88;98;116	---	4/78	45	---	---	---	---	660
---	41	6	---	69	6/64	95	1.7	---	---	---	661
210	42	8	95;100;125	2	2/75	250	5.9	---	---	---	662
123	45	6	80;110	18	5/80	20	---	1	50	---	670
COUNTY											
320	---	---	---	---	---	200	.92	---	---	---	Sc- 7
452	50	12	---	---	---	350	1.6	---	---	---	8
651	40	8	---	8	---	45	.39	---	---	---	9
520	45	10	---	8	---	95	.82	---	---	---	10
402	35	8	---	8	---	120	1.0	---	---	---	11
510	---	14	---	32	---	400	---	---	---	---	12
560	35	8	---	---	---	65	---	---	---	---	13
112	---	---	---	40	---	20	---	---	---	---	19
352	---	8	---	16	---	125	---	---	---	---	20
500	---	10	---	14	---	5	---	---	---	---	21
81	45	5	---	---	---	15	---	---	---	---	47
73	19	5	---	---	---	---	---	---	---	---	82
93	10.5	5	---	---	---	12	---	---	---	---	83
45	---	5	---	---	---	---	---	---	---	---	84
66	---	6	---	8	9/31	---	---	---	---	---	85
260	16	5	---	---	---	15	---	---	---	---	86
260	---	8	---	30	---	26	---	---	85	6.5	87
71	21	6	---	18	---	6	---	---	---	---	89
82	12.5	6	---	35	---	10	---	---	---	---	90
68.5	11	6	---	20	---	25	---	---	---	---	93
157	13.5	6	---	30	---	6	---	---	---	---	94
65	---	6	---	23	---	5	---	---	---	---	99
101	20	6	---	---	---	8	---	---	---	---	116
90	---	6	---	60	---	16	---	---	---	---	122
90	19	6	---	17	---	8	---	---	---	---	124
50	22	6	---	---	---	20	---	---	---	---	127
100	28	6	---	30	---	5	---	---	---	---	128
455	30	6	---	70	---	30	---	---	---	---	152
418	9	10	---	155	---	65	---	---	---	---	153
620	50	8	---	105	---	---	---	---	---	---	156
148	---	12	---	16	9/55	40	---	---	---	---	174
85	---	6	---	---	---	---	---	3	170	7.4	224
76	---	6	---	---	---	30	---	4	160	7.4	225
95	---	6	---	---	---	---	---	1	75	6.3	226
110	---	6	---	---	---	---	---	4	130	7.2	227
100	---	6	---	20	---	---	---	2	120	6.0	228
70	---	6	---	---	---	---	---	2	135	6.2	229
50	---	6	---	F	---	---	---	5	200	6.6	231
55	---	6	---	---	---	---	---	2	105	5.6	232
---	---	---	---	---	---	129	---	---	---	---	259
961	---	---	---	---	---	250	---	---	---	---	280
375	---	---	---	---	---	600	---	---	---	---	281
374	---	---	---	---	---	500	---	3	---	6.7	282
170	29	8	---	5	9/50	100	1.0	3	---	7.1	286
198	28	8	54;109;198	11	9/62	380	2.7	---	---	---	287
405	40	6	---	---	---	70	.6	---	---	---	323
500	34	8	50;110;165	63	4/79	75	5.4	---	---	---	326
500	81	6	96;147;256;354	58	8/64	120	1.2	---	---	---	327
500	31	8	38;53;85;160	8	8/64	115	.66	---	---	---	328
560	87	8	---	---	---	---	---	---	---	---	330
446	85	8	---	---	---	---	---	---	---	---	331
425	20	6	---	5	8/81	15	---	1	80	7.1	335
300	---	---	---	75	8/81	5	---	1	75	6.5	337
242	18	6	80;212	---	---	3	---	7	360	6.8	339
180	30	6	120	39	9/81	---	---	3	120	7.6	341
230	---	---	---	70	9/81	7	---	4	210	6.0	343
260	20	6	180	50	9/81	7	---	6	230	7.2	345
460	21	6	410	197	9/81	40	---	5	245	7.9	347
102	41	6	60;86	21	10/81	30	.5	8	440	---	349
422	41	6	---	20	10/81	---	---	7	370	---	351

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Sc- 353	4045-7620	Fountain Springs Country Club	Alvin Swank & Son, Inc.	1980	I	910	W	Mmc/---
355	4046-7619	Anthony Baran	Kermit S. Snyder	1978	H	940	S	Mmc/---
356	4046-7612	Titanium Wire Corp.	Kohl Bros., Inc.	1969	H	1560	W	Mmc/---
357	4046-7616	Melvin Johnson	Alvin Swank & Son, Inc.	1978	H	1065	S	Mmc/---
358	4046-7614	John Chowanski	Kermit S. Snyder	1969	H	1440	S	Mmc/---
359	4045-7619	Vicki Botella	---	---	H	970	S	Mmc/---
360	4046-7614	Leonard Bolinsky	Kermit S. Snyder	1969	H	1490	S	Mmc/---
362	4046-7613	V. P. Luscavage	do.	1976	H	1490	S	Mmc/---
363	4046-7618	William George	---	1971	H	1020	H	Mmc/---
365	4046-7615	Ashland Bor.	Alvin Swank & Son, Inc.	1980	P	1420	W	Mmc/---
367	4045-7624	Charles Lucas	Kermit S. Snyder	1969	H	940	S	Mmc/---
371	4037-7623	Tremont Munic. Auth.	---	1976	P	750	V	Pl/---
373	4035-7625	J. R. Brommer	---	1977	H	720	V	Mmc/---
375	4039-7629	D. A. Artz	---	1979	H	1025	H	Mmc/---
377	4039-7634	T. L. Catherman	---	1979	H	750	H	Mmc/---
379	4043-7622	M. E. Wintersteen	Kermit S. Snyder	1973	H	1030	S	Mmc/---
381	4039-7632	W. L. Harner	Paul T. Shiffer	1981	H	660	V	Mmc/---
383	4037-7633	Dept. of Mines	Kohl Bros., Inc.	1970	P	760	V	Mmc/---
385	4038-7624	Edward Miller	Kermit S. Snyder	1969	H	850	V	Pl/---
387	4038-7624	Charles Barry	do.	1969	H	850	V	Pl/---
389	4038-7624	Charles Zimmerman	do.	1970	H	855	V	Pl/---
390	4044-7620	A. L. Snyder	Richard L. Kimmel	1972	H	910	S	Mmc/---
391	4039-7629	Blair Artz	Paul T. Shiffer	1975	H	1040	H	Mmc/---
393	4039-7629	Russell Scheib	do.	1972	H	920	S	Mmc/---
395	4043-7623	Dan Green	Robert L. Brosius	1966	H	1000	S	Mmc/---
400	4046-7613	Jack Rich Inc.	Kermit S. Snyder	1980	N	1480	S	Mmc/ss
401	4046-7613	J. Makauskas	do.	1981	H	1575	S	Mmc/sh
402	4046-7614	Swade	Charles O. Moyer	1975	H	1480	S	Mmc/cong
403	4046-7615	F. Savakinas	C. S. Garber & Sons, Inc.	1980	H	1500	H	Mmc/ss
404	4046-7617	O. Heintzelman	do.	1980	H	1010	S	Mmc/---
405	4047-7619	C. Remaley	Kermit S. Snyder	1981	C	980	V	Pl/ss
406	4045-7620	L. Fetteroff	Paul T. Shiffer	1978	H	820	V	Mmc/sh
407	4049-7613	E. Schreppel	Kermit S. Snyder	1978	H	1650	F	Pp/ss
415	4037-7623	W. Ochs	Myers Bros. Drilling Contractors, Inc.	1980	H	980	S	Pl/sh
416	4037-7623	R. Shott	do.	1979	H	860	S	Pl/ss
417	4037-7623	Tremont Nursing Home	Kermit S. Snyder	1979	T	800	V	Pl/ss
418	4038-7624	C. Gauker	Fisher's Well Drilling	1979	H	960	V	Pl/sh
419	4038-7624	D. Smith	Kermit S. Snyder	1978	H	940	V	Pl/ss
420	4038-7624	K. Graeff	Fisher's Well Drilling	1980	H	940	V	Pl/sh
421	4038-7624	T. Bressler	do.	1977	H	860	V	Pl/sh
422	4038-7624	E. Young	Kermit S. Snyder	1979	H	890	V	Pl/ss
423	4039-7621	F. Artz	do.	1980	H	980	S	Pl/ss
424	4039-7626	R. Straub	Fisher's Well Drilling	1980	H	930	V	Mmc/ss
425	4039-7626	C. Dunkleberger	Fred C. Shiffer	1972	H	880	V	Mmc/sh
426	4032-7622	Wesleyan Ch.	Kermit S. Snyder	1979	T	610	V	Dh/ss
427	4031-7622	Robert Horst	do.	1977	H	580	S	Dh/ss
428	4031-7623	Richard Wheeler	Kohl Bros., Inc.	1980	H	590	V	Dh/ss
429	4031-7627	K. Donton	Fisher's Well Drilling	1980	H	520	V	Dtr/---
430	4031-7624	Kenneth Zearfoss	---	1978	H	675	V	Dh/---
431	4032-7628	H. Donton	Gill Enterprises, Inc.	1980	H	520	V	Dtr/ls
432	4032-7624	R. Haldeman	Kohl Bros., Inc.	1978	H	530	S	Dh/---
433	4032-7624	R. Betz	do.	1979	H	520	S	Dh/---
434	4031-7628	O. Haubenstine	Fisher's Well Drilling	1978	H	505	S	Dtr/---
435	4032-7628	G. Lengle	Kermit S. Snyder	1978	H	570	S	Dcsc/ss
436	4032-7626	S. Schaffer	Myers Bros. Drilling Contractors, Inc.	1979	H	690	H	Dtr/sh
437	4032-7626	Brian Bohr	Kohl Bros., Inc.	1979	H	710	H	Dtr/---
438	4037-7623	Hancock	Fisher's Well Drilling	1979	H	890	S	Pl/sh
439	4035-7616	Mrs. E. Tice	Kermit S. Snyder	1978	H	700	S	Dh/---
440	4035-7618	E. Weaver	Myers Bros. Drilling Contractors, Inc.	1980	H	625	S	Dtr/sh
441	4036-7615	R. Moyer	Kermit S. Snyder	1980	H	685	S	Sb/---
442	4035-7619	R. Stupp	Fisher's Well Drilling	1978	H	690	S	Dck/---
443	4034-7622	Hummel	Kohl Bros., Inc.	1979	H	560	S	Dh/sh
444	4033-7617	D. Kemmerling	Kermit S. Snyder	1978	H	695	S	Dciv/ss
445	4033-7617	R. Sattazahn	do.	1979	H	675	S	Dciv/ss
446	4033-7618	Irvin Miller	Fisher's Well Drilling	1980	H	750	S	Dciv/---
447	4034-7622	M. Varela	Kohl Bros., Inc.	1980	H	685	S	Dtr/---
448	4034-7619	R. Loy	Fisher's Well Drilling	1980	H	650	S	Dh/---
449	4034-7619	W. Peters	Kermit S. Snyder	1978	H	720	S	Dh/ss
450	4037-7615	G. Minnich	Myers Bros. Drilling Contractors, Inc.	1980	H	755	S	Dciv/ss
451	4039-7627	John Johns	Harrisburg's Kohl Bros.	1978	H	1040	S	Mmc/ss
452	4038-7629	O. White	Fred C. Shiffer	1979	H	960	S	Mmc/sh
453	4039-7628	Franklin Wolfgang	do.	1972	H	890	V	Mmc/sh
454	4039-7629	L. Geist	do.	1978	H	750	S	Mmc/sh
455	4041-7626	Elmer Maurer	do.	1972	H	900	V	Mmc/sh

(CONTINUED)

Total depth below land surface (feet)	Casing Depth (feet)	Casing Diameter (inches)	Depth(s) to water-bearing zone(s) (feet)	Static water level: Depth below land surface (feet)	Static water level: Date measured (mo/yr)	Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
435	---	8	---	92	10/81	70	---	---	---	---	Sc- 353
322	41	6	---	47	10/81	15	---	9	420	6.8	355
158	---	---	48;55	8	6/81	89	12.7	---	---	---	356
150	60	6	90	52	9/81	16	---	3	120	7.5	357
153	40	6	50;103	58	6/81	10	.12	8	370	6.3	358
125	---	---	---	35	10/81	---	---	1	50	5.2	359
95	34	6	55;82	43	6/81	30	1.0	4	280	5.3	360
122	41	6	42;76;108	19	7/81	26	.32	2	98	4.9	362
185	---	6	---	78	10/81	20	---	2	120	7.1	363
40	---	---	---	---	---	60	---	1	185	5.0	365
70	20	6	5;70	33	12/81	36	---	1	65	5.9	367
500	56	6	---	13	10/81	18	.09	3	200	6.7	371
101	100	6	---	9	10/81	50	---	1	50	6.7	373
215	40	6	---	90	11/81	4	---	16	845	6.7	375
378	---	6	---	60	11/81	---	---	5	240	7.6	377
122	40	6	---	54	11/81	---	---	4	320	5.8	379
160	42	7	---	11	11/81	20	---	5	275	7.8	381
305	43	14	52;85;135	52	10/70	73	.40	---	---	---	383
57	35	6	12;41;54	12	8/69	20	.71	---	---	---	385
56	35	6	12;43;54	12	8/69	20	.50	---	---	---	387
55	41	6	42;48;53	5	2/70	10	.29	---	---	---	389
150	60	6	---	36	8/81	---	---	1	60	8.2	390
190	34	6	120;175	45	6/75	6	.03	---	---	---	391
275	34	6	140;250	60	8/72	5	.02	---	---	---	393
350	22	6	180;220	40	11/66	3	---	---	---	---	395
162	41	6	56;148	17	4/81	20	.15	3	90	7.8	400
262	41	6	70;220	30	1/81	5	.03	---	---	---	401
577	---	6	425;552	105	11/75	30	.13	---	---	---	402
120	40	6	52;65;97	37	4/81	15	.19	1	50	---	403
140	20	6	65;110;120	50	8/80	10	.11	---	---	---	404
382	81	6	120;180;362	6	2/81	15	.04	---	---	---	405
100	64	6	30;60;90	14	4/81	25	.36	2	78	7.5	406
110	41	6	77;81;99	22	9/78	30	.56	3	150	---	407
125	82	6	89;117	---	7/80	30	--	---	---	---	415
100	61	6	74;92	---	6/79	20	---	---	---	---	416
302	68	6	69;130;215; 290	8	11/79	100	.93	5	180	8.0	417
101	44	6	49;84	---	6/79	6	---	5	200	8.2	418
102	47	6	60;74	1	6/78	20	.34	---	---	---	419
80	60	6	65	---	9/80	12	---	---	---	---	420
81	51	6	75	---	12/77	20	---	---	---	---	421
162	61	6	63;80;120; 150	28	5/81	12	.1	---	---	---	422
122	38	6	90;110	39	8/80	25	.41	---	---	---	423
101	60	---	74;97	---	11/80	25	---	---	---	---	424
109	39	6	65;105	40	11/72	7	.13	---	---	---	425
300	41	6	45;65;163; 243	5	11/79	10	.05	---	---	---	426
184	41	6	60;183	8	4/81	60	4.0	6	195	6.7	427
120	22	6	51;97	2	6/80	15	.13	23	820	6.8	428
102	63	6	95	---	2/80	20	---	---	---	---	429
221	87	6	98;212	---	6/78	10	---	---	---	---	430
180	38	6	65;120;130; 150	65	11/80	45	---	---	---	---	431
120	43	6	68;112	9	4/78	30	.28	---	---	---	432
100	23	6	52;87	5	4/81	20	.22	3	110	7.6	433
316	73	6	316	---	10/78	100	---	---	---	---	434
162	41	6	80;97;128; 150	35	5/78	40	.43	---	---	---	435
225	102	6	147;180;205	57	4/81	12	---	4	110	8.1	436
160	41	6	87;141	68	10/79	12	.13	---	---	---	437
321	47	6	197	35	4/81	3	---	6	205	7.5	438
122	41	6	42;56;100	12	4/81	20	.24	3	115	---	439
200	82	6	161;189	---	1/80	20	---	---	---	---	440
102	41	6	44;78;90	11	4/81	20	.36	2	60	---	441
321	55	6	105	---	4/78	6	---	---	---	---	442
120	23	6	63;81	36	10/79	20	.24	---	---	---	443
122	41	6	77;106	25	9/78	40	.77	4	120	---	444
282	41	6	57;100;150; 270	F	5/81	40	.40	5	160	---	445
121	62	6	66;92	---	1980	30	---	---	---	---	446
220	40	6	195;210	59	5/81	30	.18	4	95	---	447
321	60	6	99;188;315	34	5/81	6	---	5	150	---	448
302	62	6	70;279	7	7/78	20	.10	---	---	---	449
125	82	6	86;95;115; 122	22	5/81	30	---	3	100	---	450
260	43	6	120;250	50	10/78	5	.02	---	---	---	451
85	63	6	65;80	35	3/79	20	.15	---	---	---	452
103	37	6	82;100	45	9/72	7	.15	6	260	7.8	453
122	44	6	86;98;115	64	5/81	18	.6	3	160	7.5	454
111	42	6	60;92;107	35	10/72	10	.16	---	---	---	455

TABLE 20.

Well location Number	Well location Lat-Long	Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/lithology
Sc- 456	4042-7626	Earl Kimmel	Fred C. Shiffer	1972	H	920	S	Mmc/ls
457	4045-7622	James Freed	Alvin Swank & Son, Inc.	1977	H	920	S	Mmc/---
458	4039-7620	R. Donmoyer	Kermit S. Snyder	1978	H	980	V	Pl/sh
459	4040-7640	Albert Bordner	Fred C. Shiffer	1976	H	790	H	Dcb/sh
460	4041-7634	Paul Neugard	Paul T. Shiffer	1979	H	900	H	Dciv/sh
461	4039-7640	T. Troutman	do.	1979	H	700	S	Dcb/---
462	4040-7635	Wehry Bros.	do.	1978	S	800	V	Dciv/ss
463	4045-7620	R. Long	Kermit S. Snyder	1977	H	880	S	Mmc/ss
464	4035-7631	K. Stoneroad	Fred C. Shiffer	1975	H	840	S	Mmc/sh
465	4035-7632	Stanley Ode	Kermit S. Snyder	1974	H	850	S	Mmc/---
466	4031-7619	J. Machuzak	Kohl Bros., Inc.	1979	H	720	S	Dh/---
467	4031-7620	Carl Gettle	do.	1979	H	695	S	Dh/ss
468	4035-7615	Glenn Hummel	Kermit S. Snyder	1977	H	905	H	Dciv/---
469	4035-7616	L. Behney	do.	1977	H	710	S	Dh/---
470	4035-7615	H. Hillbish	Fisher's Well Drilling	1978	H	715	S	Dh/---
471	4032-7617	W. Martin	Kermit S. Snyder	1980	H	610	V	Dh/---
472	4032-7616	O. Kintzel	do.	1978	H	675	F	Dh/---
473	4033-7620	D. Stoltzfus	Fisher's Well Drilling	1980	H	815	H	Dtr/---
474	4034-7619	K. Kimmel	Kermit S. Snyder	1978	H	745	S	Dtr/ss
475	4033-7616	P. Riegel	do.	1978	H	620	S	Dtr/ss
476	4031-7621	S. Primeau	do.	1979	H	590	S	Dh/ss
477	4031-7622	B. Klinger	Fisher's Well Drilling	1979	H	605	S	Dh/---
478	4039-7631	Conrad Rothermul	Kohl Bros., Inc.	1977	H	720	S	Mmc/ss
479	4038-7630	J. Morris	Fred C. Shiffer	1978	H	785	S	Mmc/sh
480	4038-7632	B. Klouser	do.	1980	H	760	S	Mmc/sh
481	4038-7635	D. Schlegel	do.	1978	H	720	S	Mmc/sh
482	4038-7635	L. Deibert	do.	1979	H	715	S	Mmc/sh
483	4039-7635	M. Bixler	do.	1978	H	720	S	Mmc/sh
484	4038-7635	K. Stiely	Paul T. Shiffer	1978	H	690	S	Mmc/sh
485	4034-7633	Melvin Carl	Harrisburg's Kohl Bros.	1980	H	825	S	Mmc/sh
486	4035-7633	G. Gonzales	Fred C. Shiffer	1980	H	785	S	Mmc/sh
487	4034-7633	Robert Bowers	do.	1973	H	800	V	Mmc/sh
501	4053-7614	W. Rhoades	Alvin Swank & Son, Inc.	1979	H	1100	S	Mmc/---
502	4054-7607	J. Andrews	Robert J. Shelhamer	1978	H	1680	S	Mmc/ss
503	4054-7606	A. Fellin	do.	1978	H	1740	S	Mmc/ss
504	4053-7607	T. Gulash	do.	1978	H	1640	H	Mmc/ss
522	4036-7627	Mountain Water Auth. of Joliett	---	---	P	1450	S	Pp/---
523	4036-7627	do.	---	---	P	1450	S	Pp/---
524	4033-7623	Penn Dye and Finishing Co.	---	---	N	520	V	Dh/---
525	4033-7623	do.	---	1973	N	520	V	Dh/---
526	4046-7613	Keystone Water Co.	---	---	P	1420	S	Mmc/---
								SNYDER
Sn- 3	4049-7651	Shamokin Dam Munic. Auth.	---	---	U	440	F	DSkt/---
6	4050-7649	Maude Park	Straub	---	H	475	V	Dh/sh
16	4047-7651	Crystal Pure Ice Co.	---	---	N	425	V	DSkt/ls
18	4048-7652	Selinsgrove St. Sch. and Hosp.	---	---	T	600	V	DSkt/---
19	4048-7652	do.	---	1934	T	600	V	DSkt/---
20	4048-7653	do.	---	---	U	600	H	DSkt/---
35	4047-7702	Sheffield Farms Inc.	Harvey Keefer	---	C	500	V	Swc/---
36	4048-7703	Reading Rendering Co.	---	---	N	620	V	Dciv/---
40	4046-7707	J. C. Stahl Estate	---	---	---	620	S	DSkt/---
49	4042-7651	W. F. Gross Silk Mill	---	1921	N	460	V	Dcsc/ss
51	4038-7656	Smith & Fisher	---	---	C	400	F	Dtr/---
60	4048-7653	Selinsgrove St. Colony	---	1954	T	580	S	DSkt/---
61	4049-7653	Selinsgrove St. Sch. and Hosp.	---	1954	T	590	S	Dh/---
70	4046-7656	Freeburg Water Auth.	---	---	P	560	V	Swc/---
72	4044-7709	Beavertown Munic. Water Co.	---	1957	P	810	S	Sc/---
76	4043-7720	Carl Kauffman	Freed and Bell	1961	H	750	V	Dtr/---
77	4043-7720	Harry Collabine	do.	1961	H	715	H	Dh/---
79	4044-7721	Glen Berryman	do.	1960	H	780	S	Dh/---
80	4043-7720	S. J. Gross	do.	1960	H	680	V	Dtr/---
81	4042-7719	Henry Erb	Milton H. Romig	1960	H	765	H	Dtr/---
89	4041-7718	McClure Water Supply Co.	H. K. Honberger & Sons	1964	P	834	S	Sbm/---
90	4041-7718	do.	do.	1964	P	837	S	Sbm/---
91	4041-7718	do.	---	1942	P	828	S	Sbm/---
93	4043-7720	D. C. Boonie	Freed and Bell	---	H	725	S	Dh/---
94	4043-7717	P. A. Wright	Gilbert R. Zechman	1962	H	700	S	Dh/---
95	4044-7715	Charles Snook	do.	1961	H	680	S	Dtr/---
96	4044-7718	C. F. Roger	do.	1954	H	780	S	Dtr/---
97	4042-7719	William Moser	do.	1960	H	760	S	Doo/---
99	4043-7715	Snooks Restaurant	do.	1963	C	660	V	DSkt/---
100	4042-7719	Harry Pheasant	do.	1964	H	790	S	Swc/---
103	4042-7719	John Hassinger	Hubler Well Drilling Co.	1959	H	760	H	Dtr/---
104	4042-7719	James Wert	do.	1959	H	765	H	Dtr/---
105	4042-7719	Jack Timblin	do.	1959	H	765	H	Dtr/---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
145	38	6	100;132;140	40	10/72	4	.04	2	75	---	5c- 456
335	53	6	---	8	5/81	60	---	9	385	8.0	457
123	41	6	80;118	25	8/78	5	.06	11	850	7.4	458
97	35	6	60;92	30	12/76	7	.14	---	---	---	459
300	57	6	180;280	40	7/79	50	.18	---	---	---	460
338	61	6	185;320	119	5/81	15	.05	---	---	---	461
307	44	6	140;250;300	40	10/78	70	.27	---	---	---	462
162	40	6	60;67;150	40	11/77	40	.5	---	---	---	463
88	44	6	50;85	40	9/75	12	---	---	---	---	464
122	59	6	43;87;103	35	6/74	30	---	---	---	---	465
120	42	6	87;114	32	5/81	20	.24	2	50	---	466
140	42	6	67;107	52	10/79	15	.17	---	---	---	467
242	41	6	203;238	70	5/81	5	.03	4	120	---	468
202	41	6	177;194	10	5/81	20	.14	6	165	---	469
161	42	6	114;127;152	---	7/78	50	---	---	---	---	470
142	41	6	55;130	10	9/80	8	.07	---	---	---	471
102	51	6	65;87	20	5/78	40	1.0	---	---	---	472
261	50	6	73;153;170; 195	49	5/81	16	---	4	130	---	473
222	41	6	78;142;200	60	4/78	12	.15	---	---	---	474
122	41	6	60;78;107	55	6/78	50	1.4	---	---	---	475
162	41	6	85;147	8	5/81	20	.17	---	---	---	476
321	84	6	250;304	F	5/81	4	---	7	180	---	477
120	25	6	82;101	26	5/81	30	.36	7	225	---	478
80	51	6	68;72	35	10/78	30	1.2	---	---	---	479
102	43	6	96	38	3/80	5	.11	---	---	---	480
96	35	6	75;90	25	6/78	12	.22	---	---	---	481
109	53	6	80;103	29	6/79	8	---	---	---	---	482
80	35	6	75	6	5/81	25	.50	2	50	---	483
184	41	6	90;175	22	5/81	10	.07	7	220	---	484
130	39	6	70;125	---	11/80	60	---	---	---	---	485
83	59	6	76;81	40	3/80	25	1.7	---	---	---	486
112	34	6	85;108	35	10/73	10	.16	---	---	---	487
200	31	6	74;185	---	---	8	---	---	---	---	501
120	32	6	60;100	---	---	25	---	---	---	---	502
120	21	6	80;100	---	---	25	---	---	---	---	503
220	33	6	140;220	25	9/78	25	---	---	---	---	504
1000	---	---	---	---	---	---	---	---	---	---	522
500	---	---	---	---	---	---	---	---	---	---	523
---	---	6	---	---	---	200	---	---	---	---	524
200	---	---	---	---	---	200	---	---	---	---	525
500	---	12	---	---	---	---	---	---	---	---	526

COUNTY

Total depth below land surface (feet)	Casing depth (feet)	Casing diameter (inches)	Depth(s) to water-bearing zone(s) (feet)	Static water level depth (feet)	Date measured (mo/yr)	Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance	pH	Well number
251	88	6	---	50	---	13	---	---	---	---	Sn- 3
73	54	6	---	15	---	4	---	---	---	---	6
48	10	10	---	5	---	125	---	---	---	---	16
225	70	10	---	20	---	150	---	---	---	---	18
150	65	10	---	67	---	100	---	---	---	---	19
150	65	10	---	61	---	200	---	---	---	---	20
151	30	8	---	25	---	60	60	---	---	---	35
50	20	6	---	10	---	6	---	---	---	---	36
158	60	10	---	40	---	150	30	---	---	---	40
116	31	6	---	36	---	4	.06	---	---	---	49
54	20	6	---	10	---	10	---	---	---	---	51
357	218	10	---	108	9/54	315	---	---	---	---	60
308	76	10	---	90	---	355	5.5	---	---	7.1	61
604	---	6	---	---	---	---	---	---	---	---	70
300	90	10	---	6	5/63	180	---	---	---	6.9	72
50	21	6	40	2	9/65	8	.24	7	300	7.2	76
110	30	6	65;90;105	40	7/61	15	.2	6	245	6.8	77
95	36	6	42;91	21	5/60	7	.1	---	---	---	79
100	26	6	61;89	29	4/60	10	.14	---	---	---	80
130	32	6	45;120;125	43	1/60	10	.1	---	---	6.5	81
870	37	6	72;128;470; 530	60	---	33	---	---	---	7.6	89
412	37	6	110;184;245; 367	56	9/64	8	---	---	---	---	90
315	53	10	---	F	---	100	---	---	---	---	91
100	17	6	65;80;95	30	---	15	1.4	---	---	---	93
279	21	6	239	53	7/62	8	---	---	---	---	94
128	80	6	120	28	1/61	20	---	---	---	---	95
110	20	6	100	10	5/54	12	---	---	---	---	96
129	88	6	120	30	4/60	10	---	---	---	---	97
147	80	6	139	20	9/63	1	---	---	---	---	99
197	158	6	---	17	9/65	---	---	11	430	7.3	100
149	28	6	---	45	12/59	5	---	9	400	7.2	103
110	20	6	---	50	12/59	8	---	---	---	---	104
110	20	6	---	50	12/59	10	---	---	---	---	105

TABLE 20.

Well location		Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Number	Lat-Long							
Sn- 106	4042-7721	Warren Ball	Hubler Well Drilling Co.	1962	H	670	V	Dh/---
107	4042-7719	Leon Fisher	Gilbert R. Zechman	1965	H	740	S	Dh/---
109	4044-7719	K. E. Sterling	Milton H. Romig	1961	H	735	V	Dh/---
112	4043-7721	Clifford Wagner	do.	1962	H	720	H	Dh/---
115	4042-7719	G. R. Rarick	Gilbert R. Zechman	1964	H	720	S	Dtr/---
118	4044-7717	Fred Boonie	do.	1965	H	680	V	Dh/---
120	4043-7720	Gerald Renninger	Freed and Bell	1964	H	700	V	Dh/---
121	4043-7720	John Gross	do.	1966	H	680	S	Dtr/---
122	4043-7720	James McClosky	do.	1965	H	720	S	Dh/---
123	4043-7720	Arthur Baumgardner	do.	1965	H	740	S	Dtr/---
130	4039-7659	U. S. Geol. Survey	Gilbert R. Zechman	1968	U	740	H	Dtr/sh
131	4047-7657	Kreamer Munic. Water Auth.	---	1955	U	620	S	Sbm/---
132	4048-7657	do.	---	1956	P	475	V	DSkt/---
133	4048-7657	do.	R. R. Hornberger	1959	P	475	V	DSkt/---
134	4051-7649	Shamokin Dam Munic. Auth.	---	1949	P	500	V	Dh/---
135	4050-7649	do.	---	1956	P	460	V	Dh/---
136	4050-7649	do.	---	---	P	460	V	Dh/---
137	4047-7652	Selinsgrove Munic. Waterworks	---	---	P	560	S	DSkt/---
138	4047-7652	do.	---	1948	P	560	S	DSkt/---
139	4051-7703	Penns Creek Munic. Water Auth.	---	1955	P	715	S	Sc/---
140	4051-7653	Kratzerville Munic. Water Auth.	H. K. Honberger & Sons	---	P	700	H	Dck/---
141	4051-7654	do.	---	---	P	680	S	Dck/---
142	4048-7651	Selinsgrove St. Sch. and Hosp.	---	1948	T	575	S	DSkt/---
148*	4048-7652	M. Pope	Gilbert R. Zechman	1980	H	560	H	DSkt/ls
149	4048-7652	R. Mull	do.	1978	H	440	V	Doo/sh
150	4050-7650	Mrs. D. Shafor	do.	1978	H	480	V	Dh/sh
151	4051-7650	S. Shaw	do.	1979	H	770	S	Dcsc/---
152	4050-7649	Warren Shuman	do.	1977	H	505	V	Dh/sh
153	4050-7650	S. Young	do.	1979	H	460	V	Dh/ls
154	4039-7655	R. Kantz	do.	1977	H	460	V	Qal/---
155	4038-7659	R. Nipple	Fred C. Shiffer	1980	H	460	S	Dh/ls
156	4040-7658	H. Williams	Gilbert R. Zechman	1978	H	460	V	Dck/sh
157	4039-7657	S. Kerstetter	do.	1978	H	700	H	Dtr/ls
158	4042-7659	J. Roush	do.	1978	H	540	S	Dh/sh
159	4043-7656	G. Stahl	do.	1980	H	820	S	Dtr/---
160	4043-7657	P. Brubaker	do.	1979	H	620	S	Dtr/---
161	4043-7658	N. Hoover	Hubler Drilling and Pump Service	1979	H	610	V	Dh/---
162	4039-7657	G. Wagner	Fred C. Shiffer	1977	H	480	S	Dtr/ls
163	4039-7654	A. Stauffer	Gilbert R. Zechman	1980	H	420	V	Qal/---
164	4043-7701	P. Arbogast	do.	1979	H	600	S	Swc/ls
165	4043-7703	H. Hull	do.	1978	H	720	S	Swc/sh
166	4043-7701	J. Hilbert	do.	1980	H	620	S	Swc/sh
167	4041-7702	L. Goodling	do.	1980	H	680	S	Dh/sh
168	4041-7701	M. Yerger	do.	1977	H	680	H	Dtr/---
169	4040-7701	G. Sanders	do.	1977	H	800	S	Dciv/---
170	4041-7705	O. Maneval	do.	1977	H	740	S	Dh/sh
171	4041-7705	E. Apple	do.	1977	H	710	V	DSkt/ls
172	4041-7706	O. Graybill	do.	1977	H	700	V	Swc/---
173	4042-7705	R. Spriggle	do.	1981	H	860	S	Sbm/sh
174	4042-7704	S. Leitzel	do.	1977	H	720	S	Swc/---
175	4042-7704	E. Nornhold	do.	1977	H	690	S	DSkt/---
176	4050-7703	C. Mitchell	do.	1980	H	620	V	Dtr/sh
177	4047-7705	K. Hertzler	do.	1980	H	545	V	Swc/ls
178	4046-7706	H. Hassinger	do.	1980	H	590	S	DSkt/ls
179	4047-7702	R. Bitting	Eichelberger Well Drilling, Inc.	1981	H	530	S	Swc/---
180	4047-7702	do.	do.	1981	H	530	S	Swc/---
181	4049-7706	G. Renard	Gilbert R. Zechman	1979	H	795	S	Dtr/sh
182	4048-7706	T. Owens	do.	1980	H	845	S	Dtr/---
183	4048-7706	T. Haire	do.	1981	H	990	S	Dciv/sh
184	4051-7701	R. Loss	do.	1980	H	610	S	Dtr/---
185	4051-7700	W. Smith	do.	1979	H	720	S	Dciv/sh
186	4050-7705	J. Epstein	do.	1979	H	720	S	Sbm/sh
187	4049-7704	J. Herrall	do.	1977	H	755	S	Dtr/sh
188	4050-7703	R. Kunkel	do.	1979	H	610	S	Dtr/---
189	4048-7653	B. Danowsky	do.	1978	H	575	S	DSkt/ls
190	4050-7654	A. Webb	do.	1978	H	830	S	Dciv/sh
191	4049-7655	Per-Da Bros.	do.	1979	H	750	S	Dtr/sh
192	4048-7654	Hepco Constr. Inc.	do.	1979	P	560	S	DSkt/ls
193	4049-7652	E. Zerbe	do.	1978	H	600	S	Dh/sh
194	4051-7655	A. Walter	do.	1978	H	700	S	Dcsc/sh
195	4052-7658	A. Yerger	Wieand Brothers	1977	H	545	S	Dtr/---
196	4051-7653	Heimback	Gilbert R. Zechman	1980	H	640	S	Dcsc/---

*Well is not shown on Plate 1.

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hard-ness (gpg)	Specific conduc-tance (micro-mhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
44	21	6	---	4	4/62	10	---	3	160	6.2	Sn- 106
197	155	6	187	50	2/65	10	---	---	---	---	107
60	42	6	50	41	10/61	15	1.5	---	---	---	109
94	24	6	---	66	9/62	---	---	6	310	5.9	112
197	55	6	185	30	2/64	8	---	---	---	---	115
72	23	6	---	15	---	8	---	---	---	---	118
100	28	6	---	41	11/64	7	.1	6	260	6.9	120
100	16	6	75;90	12	2/66	25	1.9	---	---	---	121
85	50	6	68;75	10	6/65	25	.83	---	---	---	122
100	21	6	67;85	18	6/65	15	.38	---	---	---	123
100	40	6	45	17	6/68	13	.23	6	---	---	130
603	---	6	---	---	---	---	---	---	---	8.3	131
240	24	6	---	---	---	150	---	---	---	---	132
301	32	6	---	7	2/59	100	2.1	---	---	7.5	133
301	60	8	---	---	---	175	---	---	---	7.6	134
305	46	8	---	15	3/56	225	5.5	---	---	---	135
450	40	10	---	20	---	190	.8	---	---	7.2	136
487	80	8	---	---	---	325	---	---	---	---	137
503	110	10	---	---	---	410	---	---	---	---	138
145	35	6	---	---	---	---	---	---	---	6.2	139
370	20	6	160;330;370	115	---	20	---	---	---	7.4	140
191	---	6	---	78	1/61	---	---	---	---	7.2	141
448	---	6	---	98	---	---	---	---	---	7.4	142
200	180	6	183;194	50	2/80	40	---	---	---	---	148*
126	82	6	100;104;111;121	28	5/81	50	---	9	380	---	149
147	68	6	94;113;137	25	10/78	10	---	---	---	---	150
175	56	6	112;160	25	8/79	8	---	---	---	---	151
76	40	6	55;65;73	11	5/81	---	---	2	75	8.3	152
201	46	6	75;175;196	18	3/79	12	---	---	---	---	153
225	62	6	---	40	11/77	8	---	---	---	---	154
129	31	6	95;124	25	11/80	25	.50	3	150	7.80	155
301	40	6	85;240	100	8/78	3	---	---	---	---	156
201	60	6	165;185	90	7/78	7	---	---	---	---	157
151	40	6	45;120;140	25	7/78	20	---	---	---	---	158
350	42	6	80;225;338	75	5/80	7	---	---	---	---	159
101	34	---	35;49;70	20	5/79	50	---	---	---	---	160
225	20	6	200	---	1/79	8	---	3	175	---	161
93	28	6	85	22	9/81	30	3	4	210	7.70	162
144	42	6	72;125;140	50	5/80	7	---	---	---	---	163
76	49	6	68	4	9/81	9	---	5	285	7.60	164
147	89	---	112;127;135	126	9/81	30	---	4	220	7.60	165
149	102	6	105;115;130;140	15	10/80	40	---	---	---	---	166
90	40	6	48;80	30	9/80	40	---	2	130	7.60	167
126	43	6	85;108	25	8/77	15	---	---	---	---	168
151	59	6	97;151	31	9/81	8	---	4	215	7.40	169
151	42	6	98;140	60	9/77	12	---	3	185	7.70	170
246	210	6	235	40	9/77	35	---	---	---	---	171
150	60	6	70;96;121;145	20	4/77	50	---	7	400	---	172
126	40	6	71;122	5	9/81	12	---	7	325	---	173
226	120	6	155;220	---	---	3	---	---	---	---	174
176	100	6	140;169	30	3/77	7	---	7	315	7.50	175
201	40	6	70;195	70	8/80	7	---	---	---	---	176
151	56	6	89;107;128;141	29	9/81	60	---	17	440	6.90	177
126	85	6	90;95	55	9/80	15	---	---	---	---	178
75	29	6	54;57	34	9/81	50	2	---	---	---	179
275	80	6	180;239;261	30	9/81	15	.07	7	260	---	180
225	42	6	166;210	---	---	9	---	---	---	---	181
400	40	6	121;240;381	100	9/80	3	---	---	---	---	182
151	40	6	50;116;143	50	3/81	8	---	---	---	---	183
201	42	6	68;112;195	40	6/80	10	---	---	---	---	184
201	78	6	93;124;188	F	9/81	7	---	3	205	---	185
115	63	6	83;102;108	15	6/79	13	---	---	---	---	186
101	63	6	90	25	9/77	10	---	---	---	---	187
76	42	6	45;60	20	11/79	30	---	---	---	---	188
247	175	6	206;233	100	9/81	40	---	12	310	---	189
151	59	6	64;111;141	40	6/78	8	---	---	---	---	190
151	49	6	72;80;140	50	4/79	8	---	---	---	---	191
151	84	6	97;115;140	60	8/79	15	---	---	---	---	192
125	82	6	---	46	9/81	9	---	2	60	---	193
176	40	6	89;123;143	45	9/81	12	---	5	205	---	194
198	63	6	135;170	---	---	6	---	4	180	---	195
226	42	6	88;111;213	60	5/80	6	---	---	---	---	196

TABLE 20.

Well location: Number	Well location: Lat-Long	Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Sn- 197	4050-7658	G. Brouse	Gilbert R. Zechman	1977	H	765	S	Dcsc/sh
198	4049-7658	J. Hunsberger	do.	1978	H	860	S	Dcsc/---
199	4052-7659	G. Basian	do.	1977	H	545	S	Dh/sh
200	4048-7659	D. Sprenkle	do.	1978	H	570	S	Dh/---
201	4052-7650	J. Fedder	do.	1980	H	700	S	Dcsc/---
202	4053-7650	R. Brubaker	do.	1980	H	630	H	Dcsc/---
211	4043-7700	P. Rice	do.	1978	H	560	V	Doo/---
212	4043-7659	H. Heintzelman	do.	1977	H	660	S	Dh/---
213	4045-7709	R. Thomas	do.	1981	H	600	V	Swc/sh
214	4045-7711	P. Thomas	do.	1981	H	640	V	Swc/sh
215	4047-7710	D. Fritz	do.	1980	H	720	S	Dh/---
216	4047-7710	D. Jay	do.	1980	H	720	S	Dh/sh
217	4048-7708	D. Benfer	do.	1977	H	720	S	Dtr/sh
218	4048-7708	D. Rine	do.	1977	H	700	V	Dtr/sh
219	4047-7710	C. Brouse	do.	1977	H	710	V	Dtr/---
220	4043-7713	S. Woodling	do.	1979	H	700	V	Sbm/sh
221	4046-7712	W. Herman	do.	1978	H	610	V	Dtr/---
222	4048-7713	E. Grego	do.	1976	H	760	S	Swc/sh
223	4049-7709	T. Hummel	do.	1978	H	760	V	DSkt/ls
224	4050-7708	R. Moyer	do.	1979	H	720	V	Doo/sh
225	4046-7717	J. Stacey	do.	1979	H	760	S	Swc/sh
226	4046-7717	P. Wenger	do.	1979	H	880	S	Swc/---
227	4046-7716	C. Zerbe	do.	1978	H	720	S	Swc/---
236	4047-7659	R. Bilger	do.	1980	H	520	S	Dh/---
237	4049-7656	C. Long	do.	1979	H	880	H	Dciv/sh
238	4048-7656	B. Long	do.	1979	H	690	H	Dh/sh
239	4048-7657	G. Yerger	do.	1980	H	540	S	Dh/---
240	4047-7659	Feister's Auction	do.	1978	N	550	S	Swc/sh
241	4046-7658	A. Kissinger	do.	1978	H	860	S	Sc/sh
242	4046-7654	R. Savidge	do.	1980	H	460	S	DSkt/ls
243	4046-7659	J. Campbell	do.	1977	H	950	H	Sc/---
244	4047-7659	M. Fisher	do.	1979	H	600	S	Swc/---

UNION

Well location: Number	Well location: Lat-Long	Owner	Driller	Date completed	Use	Altitude of land surface (feet)	Topographic setting	Aquifer/ lithology
Un- 17	4052-7659	Rosedale Dairy	---	---	N	530	V	DSkt/ls
24	4054-7712	Laurelton St. Sch. and Hosp.	Kohl Bros., Inc.	1933	P	985	S	Sbm/---
59	4053-7659	New Berlin Munic. Waterworks	---	---	P	755	H	Sc/---
61	4053-7659	do.	---	1960	P	680	S	Sc/---
102	4051-7715	Walter Keefer	Robert H. Zimmerman	1978	H	700	S	Sbm/---
103	4051-7716	Greg Ratherman	Gilbert R. Zechman	1977	H	760	H	Sbm/ls
104	4051-7717	H. E. Ammon	do.	1978	H	730	V	Sc/sh
105	4051-7717	George Mowery	do.	1977	H	740	V	Sc/sh
106	4051-7718	Harold Klauger	do.	1977	H	835	V	Sc/sh
107	4052-7712	O. Ott	do.	1980	H	620	V	Swc/sh
108	4052-7712	E. Wright	do.	1977	H	625	S	Swc/ls
109	4052-7712	D. Snook	do.	1977	H	630	S	Swc/---
110	4052-7712	L. Camp	do.	1979	H	635	S	Swc/---
111	4052-7712	C. Hoey	Robert H. Zimmerman	1978	H	640	S	Swc/---
112	4051-7713	G. Baker	do.	1977	H	680	V	Sbm/sh
113	4051-7713	B. Bingaman	do.	1980	H	690	S	Sbm/---
114	4051-7713	J. Galer	do.	1976	H	640	V	Sbm/---
115	4051-7713	P. Bingaman	do.	1978	H	640	S	Sc/sh
116	4052-7715	J. O'Angelo	do.	1978	H	720	S	Sbm/---
139	4053-7655	R. Kline	Gilbert R. Zechman	1979	H	570	S	Dh/---
140	4053-7657	B. Vonada	do.	1979	H	510	S	Doo/---
141	4053-7658	J. Keister	do.	1979	H	780	S	Sc/---
142	4053-7658	T. Spangler	Robert H. Zimmerman	1978	H	980	S	St/---
151	4052-7702	G. Virchick	Gilbert R. Zechman	1979	H	640	S	Sc/---
152	4053-7701	R. Sauers	Robert H. Zimmerman	1979	H	760	S	Sc/ls
153	4054-7703	Manbeck Motors	Gilbert R. Zechman	1979	T	660	F	DSkt/ls
168	4053-7702	D. Mack	Robert H. Zimmerman	1979	H	630	S	Sc/---
171	4053-7709	Ch. of Faith	Gilbert R. Zechman	1979	T	665	S	DSkt/---
172	4052-7708	E. Catherman	do.	1978	H	575	V	DSkt/---
173	4054-7710	R. Boyer	Robert H. Zimmerman	1979	H	765	S	Sbm/ls
174	4054-7710	J. Voneida	do.	1978	H	750	S	Sbm/sh
175	4052-7711	R. Schell	do.	1978	H	625	V	Swc/ls
201	4053-7712	J. Boob	do.	1979	H	730	S	Swc/sh
202	4053-7713	S. Lowry	do.	1979	H	830	S	Sc/---

(CONTINUED)

Total depth below land surface (feet)	Casing		Depth(s) to water-bearing zone(s) (feet)	Static water level		Reported yield (gal/min)	Specific capacity ([gal/min]/ft)	Hardness (gpg)	Specific conductance (micromhos at 25°C)	pH	Well number
	Depth (feet)	Diameter (inches)		Depth below land surface (feet)	Date measured (mo/yr)						
151	42	6	120;142	45	10/77	7	---	---	---	---	Sn- 197
523	46	6	148;216;514	83	9/81	7	---	5	340	---	198
76	40	6	45;62	25	5/77	30	---	---	---	---	199
151	58	6	60;83;107;140	23	9/81	10	---	7	250	---	200
226	40	6	67;140;215	60	10/81	6	---	4	150	---	201
150	60	6	103;139	40	3/80	25	---	---	---	---	202
101	41	6	62;76;82;100	22	9/81	20	---	1	180	7.40	211
126	40	6	95;115	25	6/77	40	---	4	240	7.50	212
151	40	6	58;70;138;148	5	2/81	50	---	---	---	---	213
151	67	6	90;133;145	---	---	---	---	---	---	---	214
151	40	6	128;138	52	9/81	15	---	4	165	8.00	215
290	51	6	89;140;280	43	9/81	15	---	4	230	---	216
76	40	6	50;65	20	4/77	20	---	---	---	---	217
76	42	6	70	15	7/77	6	---	---	---	---	218
76	40	6	41;62	30	2/77	8	---	---	---	---	219
151	42	6	142	70	5/79	20	---	---	---	---	220
176	60	6	97;168	9	8/78	8	---	---	---	---	221
300	40	6	95;210;230;285	80	3/76	4	---	---	---	---	222
271	242	6	247;262	60	8/78	35	---	5	230	7.40	223
124	105	6	106;115	30	7/79	15	---	---	---	---	224
176	79	6	160	20	9/81	20	---	6	240	7.90	225
201	86	6	150;165;187	60	5/79	7	---	---	---	---	226
122	82	6	87;118	---	---	20	---	---	---	---	227
86	42	6	45;63;80	---	---	8	---	---	---	---	236
151	46	6	50;73;124	30	3/79	15	---	---	---	---	237
215	42	6	112;137;205;213	84	9/81	12	---	8	310	---	238
226	42	6	---	---	---	6	---	---	---	---	239
150	112	6	115;120;137;148	45	7/78	12	---	---	---	---	240
226	121	6	150;220	61	10/81	9	---	4	120	---	241
151	40	6	74;93;122;143	5	2/80	10	---	---	---	---	242
300	60	6	190;275	120	3/77	5	---	---	---	---	243
200	41	6	60;120;151	60	3/79	4	---	---	---	---	244
COUNTY											
180	43	6	---	F	---	100	4.5	---	---	---	Un- 17
606	42	10	300;400;500;606	8	---	42	---	---	---	---	24
125	---	---	---	---	---	5	---	---	---	7.2	59
390	40	6	40;68;150;390	---	---	20	1.4	---	---	7.2	61
80	40	6	65	---	1/78	60	---	---	---	---	102
426	20	6	60;142;395;408	40	4/77	15	---	---	---	---	103
125	66	6	98;115	10	9/78	30	---	---	---	---	104
76	40	6	52;61	7	1977	50	---	---	---	---	105
101	60	6	66;80;96	27	11/80	15	---	3	65	---	106
76	40	6	57;62;65;71	20	9/80	30	---	8	350	7.50	107
76	40	6	45;73	20	4/77	25	---	7	315	7.40	108
122	63	6	90;115	20	10/77	45	---	---	---	---	109
151	105	6	114;120;143	30	6/79	20	---	---	---	---	110
120	61	6	98	---	---	30	---	---	---	---	111
165	21	6	143	---	---	12	---	---	---	---	112
247	34	6	211	---	---	5	---	---	---	---	113
105	20	6	48;78	---	---	8	---	---	---	---	114
98	24	6	77	---	---	12	---	---	---	---	115
198	42	6	96;172	---	---	7	---	---	---	---	116
226	63	6	85;165;180	70	8/79	5	---	---	---	---	139
126	83	6	95;107;120	40	11/79	30	---	---	---	---	140
294	98	6	110;280	---	---	5	---	---	---	---	141
400	43	6	---	---	---	3	---	---	---	---	142
376	42	6	44;224;363	30	6/79	5	---	---	---	---	151
148	21	6	97;124	---	---	12	---	---	---	---	152
126	114	6	114;120	40	11/79	60	---	---	---	---	153
148	20	6	60;123	---	---	20	---	---	---	---	168
101	42	6	50;80;97	20	10/79	10	---	---	---	---	171
126	46	6	62;123	15	8/78	6	---	---	---	---	172
123	44	6	85;112	16	10/81	20	---	---	200	---	173
248	21	6	---	---	---	6	---	---	---	---	174
98	18	6	72	5	10/81	15	---	---	410	---	175
195	42	6	125;159	---	---	10	---	---	---	---	201
170	21	6	148	---	---	40	---	---	---	---	202

TABLE 21. RECORD OF SPRINGS

Spring number: A serial number assigned to the described spring (see Plate 1).

Location number: Degrees, minutes, and seconds of latitude and longitude, respectively.

Discharge: M, measured, E, estimated; R, reported.

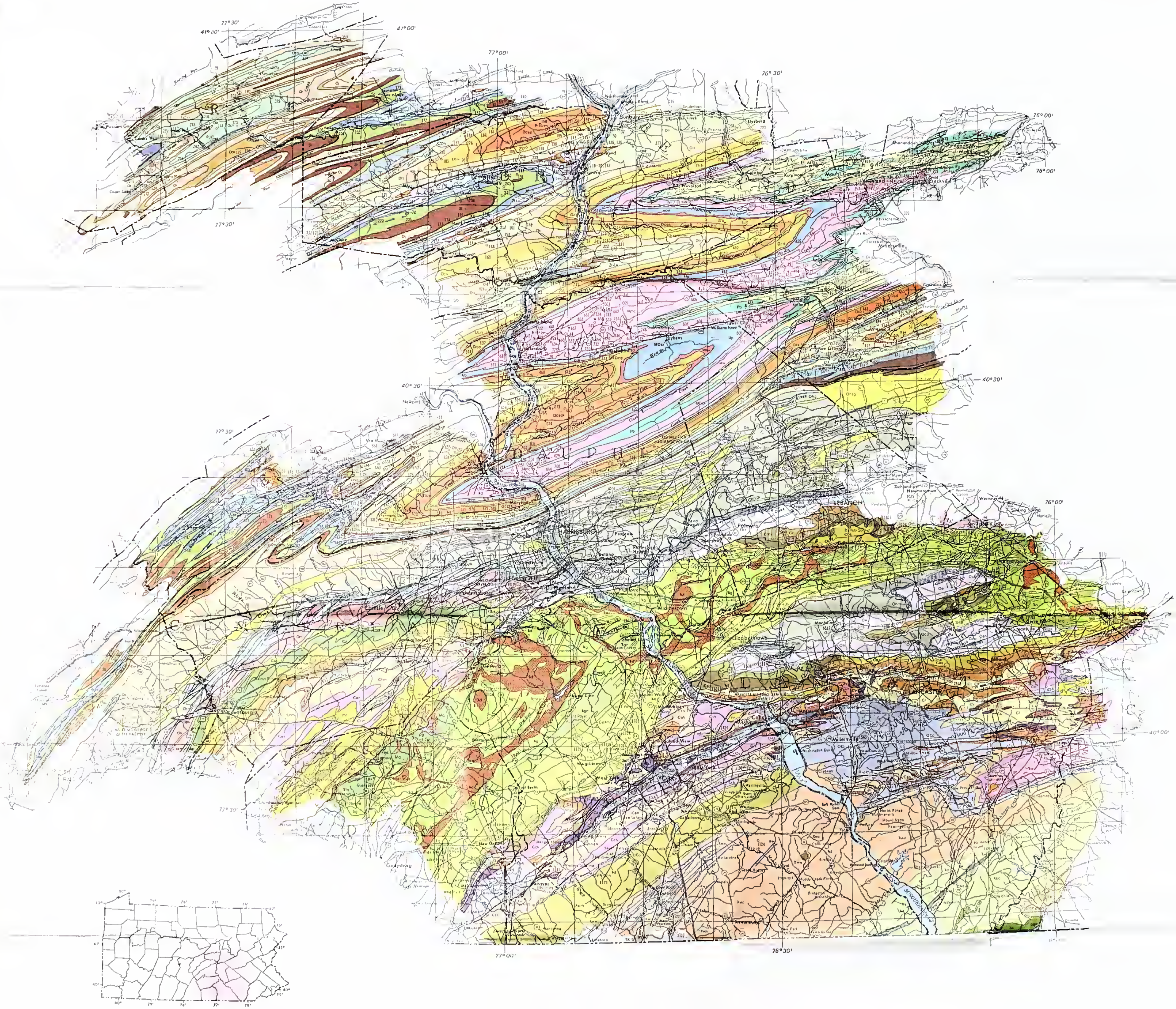
Use: C, commercial; H, domestic; N, industrial; P, public supply; U, unused.

Aquifer: Mmc, Mauch Chunk Formation; Ooo, Onondaga and Old Port Formations, undivided; OSkt, Keyser and Tonoloway Formations, undivided; Swc, Wills Creek Formation; Sbm, Bloomsburg and Mifflintown Formations, undivided; Sc, Clinton Group; Oj, Juniata Formation; Obe, Bald Eagle Formation; Ocn, Coburn Formation through Nealmont Formation, undivided; Obl, Benner Formation through Loysburg Formation, undivided.

Spring number	Location (Lat-Long)	Owner/ Name of spring	Use	Altitude of land surface (feet)	Aquifer	Discharge (gal/min)	Date	Temperature (°C)
		CENTRE COUNTY						
Ce-Sp- 3	405300-773631	W. P. Campbell/Penns Cave Spring	C	1160	Ocn	3,420 (M)	11/71	10.8
4	405121-773431	--/Rising Spring	N	1100	Obl	5,400 (M)	11/76	9.5
6	405551-772611	Rebersburg Water Co./--	P	1420	Obe	30 (E)	7/62	--
7	405607-773123	Madisonburg Water Supply/--	P	1440	Obe	--	--	--
22	404735-773639	Mt. Acres Country Club/--	C	1540	Oj	2 (M)	11/71	11.5
23	405241-772802	--/Weaver Spring	U	1060	Obl	3,140 (M)	6/67	--
24	405213-772716	--/Coburn Spring	U	1030	Obl	220 (R)	9/67	10.5
25	405525-772904	--/Spring Bank	U	1212	Ocn	580 (M)	6/67	--
26	405535-772808	--/Elk Creek Spring	U	1215	Ocn	--	--	--
29	405608-773122	Madisonburg Water Co./--	P	1470	Obe	30 (E)	--	--
30	405607-773117	Madisonburg Water Co./--	P	1480	Obe	35 (E)	--	--
31	404720-773815	S. Wilson/--	H	1400	Ocn	< 2 (M)	10/80	10.5
		PERRY COUNTY						
Pe-Sp- 2	401943-771440	Perry County Warm Springs Lodge/--	C	500	Ooo	--	--	17
3	402110-771240	--/Falling Spring	--	560	--	--	10/1883	12
5	402045-773058	Blain Water Co./--	P	--	--	--	--	--
7	402045-771334	--/--	U	440	Ooo	25 (E)	9/75	13.4
8	402054-771316	H. Stambaugh/--	H	460	Ooo	--	--	13.3
9	402113-771347	Morris Loy/--	U	525	OSkt	7.5(M)	10/75	12
10	401737-773530	Dr. Wengert/--	--	795	Sbm	--	--	12
		SCHUYLKILL COUNTY						
Sc-Sp- 2	403520-763259	Rhinhart/--	P	755	Mmc	--	--	--
3	403816-763037	Hegins Water Co./--	P	830	Mmc	50 (R)	10/30	--
4	403729-763729	Joseph Henry/--	P	640	Mmc	--	--	--
5	403819-763042	Hegins Water Co./--	P	810	Mmc	--	--	--
6	403729-763729	Joseph Henry/--	P	640	Mmc	--	--	--
7	403520-763257	Reinhard/--	P	760	Mmc	30 (E)	9/30	13.5
8	403537-763304	Philadelphia Coal and Iron/--	P	920	Mmc	--	--	--
		SNYDER COUNTY						
Sn-Sp- 1	404315-770120	Freemont Water Co./--	P	610	Ooo	7 (E)	9/64	--
2	405149-770418	Troxelville Water Co./Moyer's Spring	P	800	Sc	10	8/34	--
3	405153-770353	Troxelville Water Co./ Bell's Spring	P	700	Sc	10	8/34	--
4	405144-770426	Troxelville Water Co./Middlesworth Spring	P	780	Sc	10	8/34	--
		UNION COUNTY						
Un-Sp- 3	405328-770520	Chambers Estate	H	610	Swc	250	--	11.5

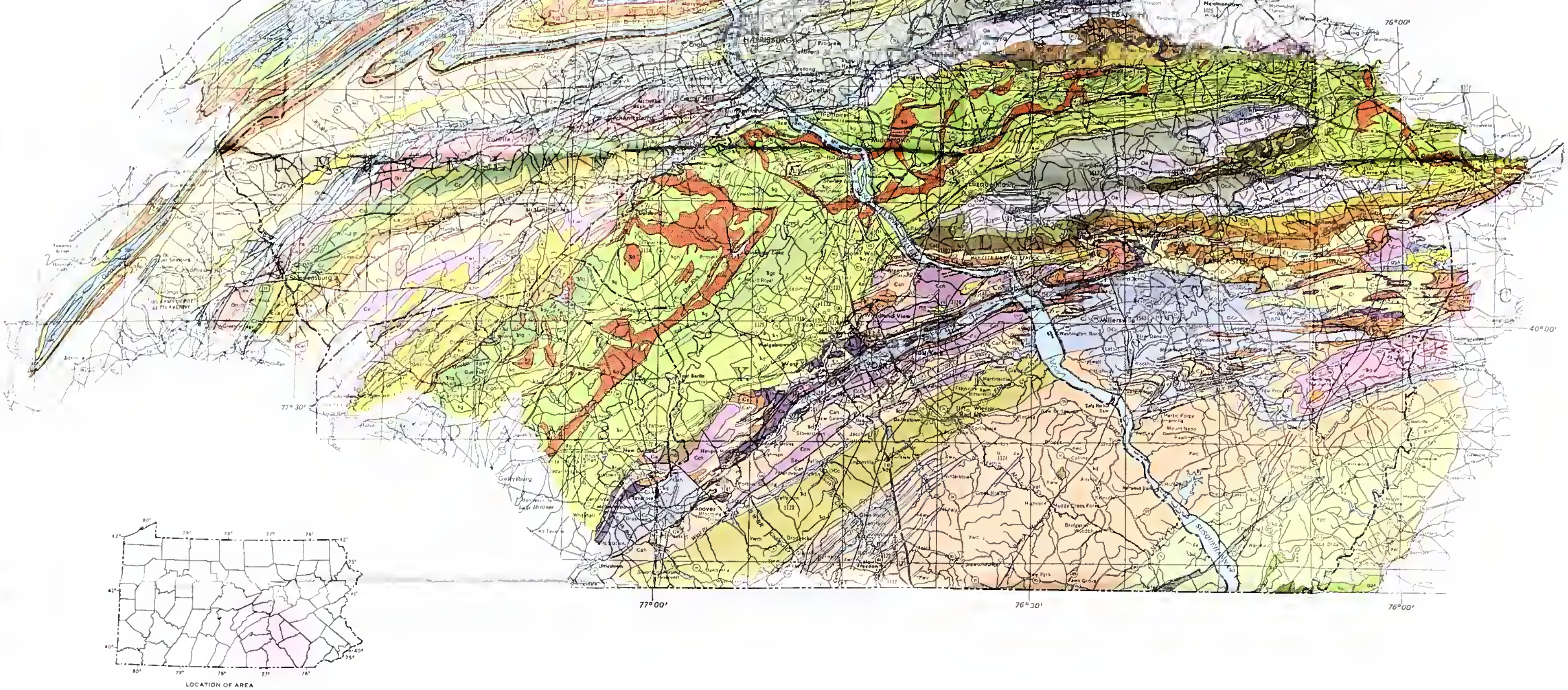
TOPOGRAPHIC AND GEOLOGIC SURVEY
Arthur A. Socolow, State Geologist

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES



EXPLANATION

System	Unit	Geologic Description	Water-Bearing Properties
	APPALACHIAN MOUNTAIN SECTION		
PENNSYLVANIAN	LLEWELLYN FORMATION (Pl)	Gray, fine- to coarse-grained sandstone, siltstone, and shale; some conglomerate and anthracite coal.	Yields small to moderate supplies in unmined areas; median yields are 20 and 29 gal/min for domestic and nondomestic wells, respectively. High levels of iron and manganese are a persistent problem.
PENNSYLVANIAN	POTTSVILLE GROUP (Pp)	Gray conglomerate, conglomeratic sandstone, sandstone, siltstone, and some anthracite coal.	Limited data are available; probably yields small to moderate amounts of soft to moderately hard water; high iron and manganese are a common problem.
MISSISSIPPIAN	MAUCH CHUNK FORMATION (Mmc)	Interbedded brownish-gray to grayish-red siltstone, claystone, and brownish-gray to pale-red, poorly cemented sandstone	Median yields of 15 and 70 gal/min for domestic and nondomestic wells, respectively; more than one third of the wells drilled for high yields produce over 100 gal/min. High nitrate may be a problem in agricultural areas.
MISSISSIPPIAN	POCONO FORMATION (Mp)	Light-gray to medium-dark-gray sandstone and minor siltstone; commonly conglomeratic at the base and in the middle.	Unimportant as aquifers because of high topographic position; small supplies of soft water may be possible.
MISSISSIPPIAN	SPECHTY KOPF FORMATION (MDsk)	Light- to olive-gray, crossbedded sandstone and siltstone.	
DEVONIAN	CATSKILL FORMATION: DUNCANNON MEMBER; CLARKS FERRY MEMBER (Dcl); BUDDYS RUN MEMBER (Dcb); SHERMAN CREEK MEMBER (Dcsc); LONG RUN MEMBER (Dcl); BEAVERDAM RUN MEMBER; IRISH VALLEY MEMBER (Dci); WALCKSVILLE AND TOWAMENSING MEMBERS, UNDIVIDED (Dcwt)	Succession of grayish-red sandstone, siltstone, and shale; some gray sandstone and conglomerate.	Yields small to moderate supplies; median yields for domestic and nondomestic wells are 14 and 50 gal/min, respectively. Over one third of the wells produce water high in iron and manganese.
DEVONIAN	TRIMMERS ROCK FORMATION (Dtr)	Medium-gray to olive-gray siltstone, shale, and some very fine grained sandstone. 100 feet of dark-gray to black shale occurs at the base.	Median yield of domestic wells is 12 gal/min; small- and some moderate-sized supplies are possible. Over one third of the wells produce water high in iron and manganese.
DEVONIAN	HAMILTON GROUP (Dh)	Consists of the Mahantango Formation and the Marcellus Formation. Mahantango Formation—Gray, brown, and olive siltstone, light-olive-gray silty claystone, and fine- to coarse-grained siliceous sandstone. Marcellus Formation—Black to dark-gray claystone, medium-gray siltstone, and very fine grained sandstone.	Median yields are 15 and 75 gal/min for domestic and nondomestic wells, respectively. Over two thirds of the wells produce water high in iron and manganese; hydrogen sulfide is often a problem, especially in the lower part of the unit.
DEVONIAN	ONONDAGA AND OLD PORT FORMATIONS, UNDIVIDED (Doo)	Onondaga Formation—Shaly limestone interbedded with calcareous shale. Old Port Formation—Sequence of gray chert, siltstone, claystone, medium- to coarse-grained sandstone, and shaly limestone.	Too thin to be of importance as an aquifer in most of the basin; large yields of hard water may be possible at a few locations.
DEVONIAN / SILURIAN	KEYSER AND TONOLOWAY FORMATIONS, UNDIVIDED (DSkt)	Keyser Formation—Gray limestone, argillaceous limestone, and claystone. Tonoloway Formation—Dark- to medium-gray laminated limestone and argillaceous limestone.	Very large yields are possible; median yields of domestic and nondomestic wells are 15 and 100 gal/min, respectively. Water is very hard; high sulfates are reported to be a problem in some localities.
SILURIAN	WILLS CREEK FORMATION (Swc)	Olive- and greenish-gray, calcareous and noncalcareous shale and argillaceous limestone; a few interbeds of grayish-red shale and gray, fine-grained sandstone.	Median yields are 15 and 20 gal/min for domestic and nondomestic wells, respectively; large supplies may be possible. Water is hard to very hard.
SILURIAN	BLOOMSBURG FORMATION (Sb); BLOOMSBURG AND MIFFLINTOWN FORMATIONS, UNDIVIDED (Sbm)	Bloomsburg Formation—Grayish-red shale and mudstone containing some interbeds of light-gray, very fine grained sandstone. Mifflintown Formation—Dark-gray calcareous shale and interbedded medium- to dark-gray limestone.	Yields sufficient quantities for small to moderate supplies; median yield of domestic wells is 12 gal/min. Half of the samples collected contained excessive iron and manganese.
SILURIAN	CLINTON GROUP (Sc) (SHAWANGUNK FORMATION[1], Ss)	Consists of the Keefer and Rose Hill Formations. Keefer Formation—Light- to dark-gray, hematitic sandstone containing interbeds of dark-gray shale and limestone. Rose Hill Formation—Light-olive-gray to brownish-gray shale containing some minor interbedded siltstone and sandstone.	Median yield of domestic wells is 12 gal/min; large supplies are generally difficult to obtain. Water is soft to moderately hard.
SILURIAN	TUSCARORA FORMATION (St)	Light- to medium-gray sandstone and minor interbedded shale.	Limited data are available; should provide small supplies of soft groundwater.
ORDOVICIAN	JUNIATA FORMATION (Oj)	Brownish- to grayish-red sandstone; some siltstone and shale.	
ORDOVICIAN	BALD EAGLE FORMATION (Obe)	Gray to olive-gray and grayish-red, fine- to coarse-grained sandstone and some conglomerate.	
ORDOVICIAN	REEDSVILLE FORMATION (Or)	Medium-gray, thin- to medium-bedded silty shale and shaly siltstone; a few interbeds of very fine grained sandstone.	Yields small to moderate supplies; median yield of 16 domestic wells is 27 gal/min. Water often contains excessive iron and manganese and occasionally contains objectionable amounts of hydrogen sulfide.
ORDOVICIAN	COBURN FORMATION THROUGH NEALMONT FORMATION, UNDIVIDED (Ocn)	Coburn Formation—Medium-gray limestone. Salona Formation—Very dark gray to black shaly limestone and calcareous shale. Nealmont Formation—Medium-gray limestone.	Median yields are 12 and 50 gal/min for domestic and nondomestic wells, respectively; small to moderate supplies can generally be developed. Water is very hard.
ORDOVICIAN	BENNER FORMATION THROUGH LOYSBURG FORMATION, UNDIVIDED (Obl)	Benner Formation—Light- to dark-gray, thick-bedded limestone. Snyder Formation—Light- to medium-gray limestone. Hatter Formation—Medium-gray argillaceous limestone. Loysburg Formation—Medium-bedded limestone overlying laminated, dolomitic limestone and dolomite.	
ORDOVICIAN	BELLEFONTE FORMATION (Obf)	Primarily medium- to thick-bedded, gray dolomite containing minor amounts of chert and sandstone.	Limited data are available; large supplies of very hard water may be possible.
ORDOVICIAN	AXEMANN FORMATION (Oa)	Mainly limestone; contains a few layers of dolomite.	
	GREAT VALLEY SECTION (west of Susquehanna River)[3]		
ORDOVICIAN	MARTINSBURG FORMATION (Om) (Omgs, Oml); HAMBURG SEQUENCE (Oh) (Ohg, Ohl)	Chiefly dark-gray shale (Om), separated by a middle member consisting of graywacke sandstone and siltstone (Omgs); a thin zone of argillaceous limestone occurs at the base (Oml). East of Carlisle, the unit is replaced by a heterogeneous sequence of rocks consisting of red, green, and gray shale and siltstone (Oh), coarse sandstone and graywacke (Ohg), and limestone conglomerate and limestone (Ohl).	Well yields are sufficient for small to moderate supplies; maximum reported yield is 200 gal/min. Water is often high in iron and manganese, and occasionally high in hydrogen sulfide.
ORDOVICIAN	CHAMBERSBURG FORMATION (Oc)	Dark-gray, thin- to medium-bedded, nodular limestone and minor units of thin, argillaceous limestone.	Yields adequate amounts of water for small to moderate supplies; calculated median sustained yield is 11 gal/min. Water often contains high concentrations of iron and manganese.
ORDOVICIAN	ST. PAUL GROUP (Osp)	Light-gray, thick-bedded high-calcium limestone; medial zone of medium-gray, black-chert-bearing limestone and dolomite.	Yields ample amounts of water for small to moderate supplies; calculated median sustained yield is 82 gal/min. Water is very hard and high in dissolved solids.
ORDOVICIAN	PINESBURG STATION FORMATION (Ops)	Thick-bedded, light- to medium-gray dolomite containing interbeds of blue-gray limestone.	Limited data are available; probably one of the poorer yielding units in this rock sequence.
ORDOVICIAN	ROCKDALE RUN FORMATION (Orr)	Medium-bedded, very light gray, ... has a pinkish cast in the lower part; middle and upper portions consist of light-gray limestone; dolomite beds occur throughout the unit but are most abundant near the top.	Very large yields are possible; calculated median sustained yield is 400 gal/min; most yielding zones are less than 100 feet in depth. Water is very hard and high in dissolved solids.
ORDOVICIAN	STONEHENGE FORMATION (Os)	Light- to medium-gray, micrograined to micritic limestone.	Limited data are available; probably yields sufficient amounts of very hard water for small to moderate supplies.
	SHADYGROVE FORMATION (Csg)	Light-gray to pinkish-gray micritic limestone; a few beds of sandstone, dolomitic limestone, and limestone.	Comparatively low yielding unit; median calculated sustained yield is 26 gal/min. Water is very hard and high in dissolved solids.
	ZULLINGER FORMATION	Medium-gray limestone and banded ...	Twenty percent of domestic wells require borehole storage to meet ...
	BLUE RIDGE PROVINCE[4]		
CAMBRIAN	ANTIETAM FORMATION (Ca)	Chiefly coarse-grained, quartzose sandstone; lower part is dense, resistant quartzite.	Limited data are available; probably yields small supplies of moderately soft water.
CAMBRIAN	HARPERS FORMATION (Ch) (MONT ALTO MEMBER, Chm)	Graywacke siltstone and graywacke; contains a prominent interval of medium- to thick-bedded, medium-grained quartzite (Chm).	Reported yields range from 5 to 25 gal/min; median for domestic wells is 10 gal/min. Water is generally hard.
CAMBRIAN	WEVERTON AND LOUDOUN FORMATIONS, UNDIVIDED (Cwl)	Weverton Formation—Sequence of quartz phyllites, quartzose graywackes, and quartzites. Loudoun Formation—Dark-gray, dusky-blue, or very dusky red purple phyllites locally interbedded with fine-grained, laminated graywacke.	Limited data are available; well yields are likely to be low because of the topographic position of these formations as ridge formers.
PRECAMBRIAN	METABASALT[5] (mb)	Characteristically green, greenish-gray, and gray, massive, well-cleaved rock of fine to medium grain size.	Twenty-five percent of domestic wells have yields less than 3 gal/min; supplemental storage may be needed in many wells to meet minimum domestic needs. Water is moderately soft.
PRECAMBRIAN	METARHYOLITE (mr)	Mainly hard, dense, fine-grained rock of purplish color, in part containing isolated crystals of feldspar and quartz.	
PRECAMBRIAN	GREENSTONE SCHIST (gs)	Greenish-gray, lustrous phyllite and schist.	Limited areal extent; wells are likely to produce small quantities of soft water.
	READING PRONG SECTION[7]		
CAMBRIAN	HARDYSTON FORMATION (Cha)	Light-gray quartzite and feldspathic sandstone; conglomerate occurs at the base.	Limited data are available; probably yields small to moderate supplies of soft to moderately hard water.
PRECAMBRIAN	METADIABASE (md)	Dark-gray, fine-grained intrusives.	Yields small supplies that may be marginally adequate to inadequate for domestic use; many wells require supplemental storage to meet minimum needs. Water is soft and may be corrosive to plumbing.
PRECAMBRIAN	GRAPHITIC GNEISS (gg)	Consists dominantly of quartz and feldspar; contains varying amounts of graphite.	
PRECAMBRIAN	HORNBLENDE GNEISS (hg)	Light, medium grained; consists predominantly of quartz and feldspar.	
PRECAMBRIAN	GRANITIC GNEISS (gn)	Dark, medium grained; includes some rocks that are probably sedimentary in origin.	
	TRIASSIC LOWLAND SECTION[8]		
TRIASSIC	DIABASE (Td)	Medium- to coarse-grained, dark-gray rock composed mainly of plagioclase feldspar, pyroxene, and accessory magnetite.	Yields small supplies of water that are often inadequate for domestic use; about 25 percent of the wells require supplemental storage to meet minimum needs. Water is hard and commonly of poor quality because of the shallow groundwater circulation system.
TRIASSIC	GETTYSBURG FORMATION (Tg) (Tgl, Tgq, Tgh, Tgc)	Includes five distinct lithologies that are interbedded with one or more of the other lithologies: fanglomerate composed of poorly sorted pebbles to boulders of white vein quartz and red siltstone in a red silty sandstone matrix (Tgq); fanglomerate composed of pebbles to boulders of limestone in a matrix of red or gray sandstone or shale (Tgl); fine- to coarse-grained, red, brown, and gray sandstone containing some pebbles and cobbles of well-rounded, pink to light-gray vein quartz and quartzites (Tgc); red, green, and gray shale and argillite (Tgh), and maroon silty mudstone and shale (Tg).	Median yield of domestic wells from all lithologies combined is 10 gal/min. Median yields for nondomestic wells range from 21 to 185 gal/min; the highest yields are obtained from shale near Middletown and the lowest from quartz conglomerate. Water from the quartz conglomerate is soft and low in dissolved solids, water from the rest of the formation is generally of good quality and hard.
TRIASSIC	HAMMER CREEK FORMATION (Th) (Thl, Thc)	Fanglomerate composed of pebbles to boulders of limestone in a matrix of red or gray sandstone or shale (Thl); cobble and pebble quartz conglomerate with red sandstone (Thc), and reddish brown, fine- to coarse-grained, quartzose sandstone and a few red shale interbeds (Th).	Median yield of domestic wells from all lithologies combined is 20 gal/min. Median yields for nondomestic wells range from 90 to 144 gal/min, the highest yields are obtained from shale and the lowest from sandstone. Hardness ranges from soft for the quartz conglomerate to hard and sometimes very hard for the limestone conglomerate.
TRIASSIC	NEW OXFORD FORMATION (Tn) (Tnc); STOCKTON FORMATION (Ts)	New Oxford Formation—Red mudstone and shale and fine-grained sandstone interbedded with arkosic sandstone; conglomerate and arkosic beds are common in the lower part (Tnc). Stockton Formation—Light-gray, coarse-grained arkosic sandstone, includes reddish-brown mudstone and shale	Reported yields range from 1 to 330 gal/min and the median is about 12 gal/min; more than moderate amounts (more than 50 gal/min) of water may be difficult to obtain. Water is generally hard; 16 percent of the wells contained excessive iron and 27 percent contained excessive manganese
ORDOVICIAN	BEEKMANTOWN GROUP[9] (Ob)	Occurs in a small area near York Springs, Adams County. Primarily white or gray marble, some of which is coarsely crystalline and veined with calcite	Limited data are available, probably a fair to good aquifer that yields moderate to large quantities of very hard water
	CONESTOGA VALLEY SECTION[10]		
ORDOVICIAN	COCALICO FORMATION (Oco)	Bluish black to dark-gray fissile shale, purple and green shale containing thin quartzite occurs near the base	Reported yields range from 1 to 100 gal/min, about half are less than 20 gal/min. Water is probably moderately hard
ORDOVICIAN	HERSHEY AND MYERSTOWN FORMATIONS, UNDIVIDED (Ohm)	Hershey Formation—Dark-gray to black, thin bedded, argillaceous limestone. Myerstown Formation—Medium- to dark gray, platy, medium crystalline limestone, carbonaceous at the base.	Limited areal extent, water bearing properties are unknown
ORDOVICIAN	ANNVILLE FORMATION (Oan)	Light-gray, massive, high-calcium limestone	
ORDOVICIAN	ONTELAUNEE FORMATION (Oo)	Gray, very finely to finely crystalline, partly laminated dolomite.	Limited areal extent, water bearing properties are unknown
ORDOVICIAN	EPLER FORMATION (Oe)	Gray interbedded limestone and dolomite, abundant white beds in the lower part.	Reported yields range from 1 to 600 gal/min, the median is about 30 gal/min. Based on specific capacity data, the Stonehenge is the highest yielding aquifer in the Conestoga Valley sequence. Water is very hard, high levels of nitrate are a common problem.
ORDOVICIAN	STONEHENGE FORMATION (Os)	Gray, finely crystalline limestone containing dark gray silty laminations	
ORDOVICIAN / CAMBRIAN	CONESTOGA FORMATION (OCc)	Gray, fine- to coarse-crystalline limestone, commonly contains laminations that are clayey, graphitic, and micaceous; contains basal beds of carbonate conglomerate	Maximum reported yield is 250 gal/min, typical sustained yield calculated from specific-capacity data is 20 gal/min, about one in four wells should yield 140 gal/min. Water is very hard; about half of the wells exceed the limit recommended for nitrate by the Environmental Protection Agency (1975).
CAMBRIAN	RICHLAND FORMATION (Cr)	Gray interbedded limestone and dolomite, contains beds of fine conglomerate	Reported yields of six wells range from 2 to 30 gal/min, based on specific capacity data these rocks are a poor source for public and industrial supplies but are adequate for domestic use. Water is very hard and often contains high concentrations of nitrate and dissolved solids
CAMBRIAN	MILLBACH FORMATION (Cm)	White to pinkish gray interbedded limestone and dolomite.	
CAMBRIAN	SNITZ CREEK FORMATION (Csc)	White to pinkish gray, interbedded limestone and dolomite; scattered beds of sandstone	
CAMBRIAN	BUFFALO SPRINGS FORMATION (Cbs)	...	
CAMBRIAN	ZOOKS CORNER FORMATION (Czc)	Gray, very finely crystalline dolomite; commonly silty and sandy, contains some limestone.	Reported yields of five wells range from 4 to 105 gal/min, based on specific-capacity data this unit is a poor source for public and industrial supplies, but is adequate for domestic use. Water is very hard
CAMBRIAN	LEDGER FORMATION (Cl)	Light gray, coarsely crystalline dolomite	Reported yields range from 2 to 650 gal/min, the median is 30 gal/min. Based on specific capacity data, this is one of the most productive aquifers in this physiographic section, about one of four wells was estimated to have the potential for producing 400 gal/min in York County. Water is very hard, high concentrations of manganese and nitrate are an occasional problem



SYMBOLS

Contact
Includes approximately located and inferred contacts.

Water well and county well number
In congested areas, only selected wells are shown

Fault
Includes approximately located and inferred faults
Dashed where uncertain.

Water well for which there is a chemical analysis, and county well number

Spring and county spring number

EXPLANATION

Soft (0-50 mg/L)

Moderately hard (51-100 mg/L)

Hard (>100 mg/L)

Colors are generalized, some wells yield water that is softer or harder than the color range on the map indicates

17.1 milligrams per liter = 1 grain per U.S. gallon

MEDIAN HARDNESS OF GROUNDWATER

GEOLOGIC MAP OF THE LOWER SUSQUEHANNA RIVER BASIN SHOWING THE LOCATIONS OF SELECTED WELLS AND SPRINGS

HYDROGEOLOGY
BY
LARRY E. TAYLOR
WILLIAM H. WERKHEISER

1984

SCALE 1:250,000

System	Map unit	Description	Hydrologic characteristics
SILURIAN	BLOOMSBURG AND MIFFLINTOWN FORMATIONS, UNDIVIDED (Sbm)	Mifflintown Formation—Dark-gray calcareous shale and medium- to dark-gray limestone.	[illegible]
	TUSCARORA FORMATION / CLINTON GROUP (Sc)	Consists of the Keefer and Rose Hill Formations. Keefer Formation—Light- to dark-gray, hematitic sandstone containing interbeds of dark-gray shale and limestone. Rose Hill Formation—Light-olive-gray to brownish-gray shale containing some minor interbedded siltstone and sandstone. Light- to medium-gray sandstone and minor interbedded shale.	Median yield of domestic wells is 12 gal/min; large supplies are generally difficult to obtain. Water is soft to moderately hard.
ORDOVICIAN	JUNIATA FORMATION (Oj)	Brownish- to grayish-red sandstone; some siltstone and shale.	Limited data are available; should provide small supplies of soft groundwater.
	BALD EAGLE FORMATION (Obe)	Gray to olive-gray and grayish-red, fine- to coarse-grained sandstone and some conglomerate.	
	REEDSVILLE FORMATION (Or)	Medium-gray, thin- to medium-bedded silty shale and shaly siltstone; a few interbeds of very fine grained sandstone.	Yields small to moderate supplies; median yield of 16 domestic wells is 27 gal/min. Water often contains excessive iron and manganese and occasionally contains objectionable amounts of hydrogen sulfide.
	COBURN FORMATION THROUGH NEALMONT FORMATION, UNDIVIDED (Ocn)	Coburn Formation—Medium gray limestone. Salona Formation—Very dark gray to black shaly limestone and calcareous shale. Nealmont Formation—Medium-gray limestone.	Median yields are 12 and 60 gal/min for domestic and nondomestic wells, respectively; small to moderate supplies can generally be developed. Water is very hard.
	BENNER FORMATION THROUGH LOYSBURG FORMATION, UNDIVIDED (Obl)	Benner Formation—Light- to dark-gray, thick-bedded limestone. Snyder Formation—Light- to medium-gray limestone. Hatter Formation—Medium-gray argillaceous limestone. Loysburg Formation—Medium-bedded limestone overlying laminated, dolomitic limestone and dolomite.	
	BELLEFONTE FORMATION (Obf)	Primarily medium- to thick-bedded, gray dolomite containing minor amounts of chert and sandstone.	Limited data are available; large supplies of very hard water may be possible.
	AXEMANN FORMATION (Oa)	Mainly limestone; contains a few layers of dolomite.	

GREAT VALLEY SECTION (west of Susquehanna River)[3]

System	Map unit	Description	Hydrologic characteristics
ORDOVICIAN	MARTINSBURG FORMATION (Om; Omgs, Oml) / HAMBURG SEQUENCE (Oh; Ohg, Ohl)	Chiefly dark-gray shale (Om), separated by a middle member consisting of graywacke sandstone and siltstone (Omgs); a thin zone of argillaceous limestone occurs at the base (Oml). East of Carlisle, the unit is replaced by a heterogeneous sequence of rocks consisting of red, green, and gray shale and siltstone (Oh), coarse sandstone and graywacke (Ohg), and limestone conglomerate and limestone (Ohl).	Well yields are sufficient for small to moderate supplies, maximum reported yield is 200 gal/min. Water is often high in iron and manganese, and occasionally high in hydrogen sulfide.
	CHAMBERSBURG FORMATION (Oc)	Dark-gray, thin- to medium-bedded, nodular limestone and minor units of thin, argillaceous limestone.	Yields adequate amounts of water for small to moderate supplies, calculated median sustained yield is 11 gal/min. Water often contains high concentrations of iron and manganese.
	ST. PAUL GROUP (Osp)	Light-gray, thick-bedded high-calcium limestone; medial zone of medium-gray, black-chert-bearing limestone and dolomite.	Yields ample amounts of water for small to moderate supplies, calculated median sustained yield is 82 gal/min. Water is very hard and high in dissolved solids.
	PINESBURG STATION FORMATION (Ops)	Thick-bedded, light- to medium gray dolomite containing interbeds of blue-gray limestone.	Limited data are available; probably one of the poorer yielding units in this rock sequence.
	ROCKDALE RUN FORMATION (Orr)	Medium-bedded, very light-gray, chert-bearing limestone; has a pinkish cast in the lower part; middle and upper portions consist of light-gray limestone; dolomite beds occur throughout the unit but are most abundant near the top.	Very large yields are possible; calculated median sustained yield is 405 gal/min; most yielding zones are less than 100 feet in depth. Water is very hard and high in dissolved solids.
	STONEHENGE FORMATION (Os)	Light- to medium-gray, micrograined to micritic limestone.	Limited data are available, probably yields sufficient amounts of very hard water for small to moderate supplies.
CAMBRIAN	SHADYGROVE FORMATION (Csg)	Light-gray to pinkish-gray micritic limestone; a few beds of sandstone, dolomitic limestone, and limestone.	Comparatively low yielding unit, median calculated sustained yield is 26 gal/min. Water is very hard and high in dissolved solids.
	ZULLINGER FORMATION (Cz)	Medium-gray limestone and banded limestone containing siliceous seams; some thick beds of dolomite and calcareous sandstone.	Twenty percent of domestic wells require borehole storage to meet minimum needs; calculated median sustained yield is 82 gal/min. Water is very hard and high in dissolved solids.
	ELBROOK FORMATION (Ce)	Interbedded calcareous shale, argillaceous limestone, and limestone in beds a few feet to tens of feet thick.	Very large yields are possible, calculated median sustained yield is 218 gal/min. Water is very hard and high in dissolved solids.
	WAYNESBORO FORMATION (Cwb)	Quartzitic sandstone containing thick interbeds of medium- to dark gray silty mudstone; probably includes some interbeds of carbonate rocks.	Limited data are available, calculated median sustained yield is 172 gal/min. Water is very hard and high in dissolved solids.
	TOMSTOWN FORMATION (Ct)	Covered with alluvium and colluvium throughout the area, massive dolomite is present in the middle of the unit; limestone, siltstone, and claystone probably occur in the lower part and possibly in the upper part.	Very large yields are possible, calculated median sustained yield is 1,050 gal/min, overlying alluvium may cause drilling and development problems. Water is hard and high in dissolved solids.

GREAT VALLEY SECTION (east of Susquehanna River)[4]

System	Map unit	Description	Hydrologic characteristics
ORDOVICIAN	HAMBURG SEQUENCE (Oh; Ohg, Ohgo, Ohl, Ohv)	Variable lithology; primarily greenish-gray shale (Oh); lesser amounts of graywacke (Ohg), shale containing zones of graywacke (Ohgo), limestone (Ohl), and andesite extrusives (Ohv).	Yields small to moderate amounts of water; median yields of domestic wells range from about 10 to 20 gal/min; median yields of nondomestic wells range from about 60 to 70 gal/min, although some parts of the unit are reported to have a median yield in excess of 100 gal/min. Water is generally hard and contains a moderate amount of dissolved solids.
	HERSHEY AND MYERSTOWN FORMATIONS, UNDIVIDED (Ohm)	Hershey Formation—Dark-gray argillaceous limestone. Myerstown Formation—Gray, crystalline, thin-bedded limestone.	Limited data are available, reported to be poor aquifers. Water is very hard and high in dissolved solids.
	ANNVILLE FORMATION (Oan)	Light-gray, finely crystalline, thick-bedded high-calcium limestone.	Very large yields are possible; median yield of nondomestic wells is in excess of 100 gal/min, some wells yield 1,000 gal/min or more. Water is very hard and very high in dissolved solids.
	ONTELAUNEE FORMATION (Oo)	Medium-dark-gray dolomite containing interbeds of medium-gray limestone.	
	EPLER FORMATION (Oe)	Interbedded medium-gray limestone and dolomite, containing calcarenite lenses.	Very large yields are possible from parts of the unit, median yield of nondomestic wells is in excess of 200 gal/min, some wells yield 1,000 gal/min or more. Water is very hard and high in dissolved solids.
	RICKENBACH FORMATION (Ork)	Gray, cherty dolomite containing subordinate limestone interbeds.	Limited data are available; median yield of four domestic wells is 18 gal/min. Water is very hard and high in dissolved solids.
	STONEHENGE FORMATION (Os)	Medium-gray crystalline limestone, cherty in the upper part; limestone conglomerate is present near the base.	Specific-capacity data suggest that large yields are possible; median yield of six domestic wells is 20 gal/min. Water is very hard and high in dissolved solids.
CAMBRIAN	RICHLAND FORMATION (Cr)	Gray, thick-bedded, finely crystalline dolomite containing some interbeds of limestone and chert.	Moderate to large supplies are possible, median yield of domestic wells is 11 gal/min and median yield of nondomestic wells is 200 gal/min. Water is very hard and high in dissolved solids.
	MILLBACH AND SCHAEFFERSTOWN FORMATIONS, UNDIVIDED (Cms)	Millbach Formation—Pinkish gray to light-gray laminated limestone. Schaefferstown Formation—Light- to medium-gray, finely crystalline limestone.	Moderate to large supplies are possible; reported median yields of domestic and nondomestic wells are 40 and 190 gal/min, respectively. Water is very hard and high in dissolved solids.
	SNITZ CREEK FORMATION (Csc)	Medium-gray dolomite; sandstone beds are present near the top.	Yields sufficient amounts of water for small to moderate supplies; large supplies are possible in some areas; median yield of six domestic wells is 6 gal/min. Water is very hard and high in dissolved solids.
	BUFFALO SPRINGS FORMATION (Cbs)	Light- to pinkish-gray limestone interbedded with light-gray dolomite.	Medians are 10 and 82 gal/min for domestic and nondomestic wells, respectively; about 25 percent of the nondomestic wells have yields in excess of 150 gal/min. Water is hard and high in dissolved solids.
	LEITHSVILLE FORMATION (Cl)	Predominantly gray dolomite with considerable chert in the lower part, shaly in the upper part.	Limited data are available, reported median yield of 100 gal/min for three nondomestic wells in Lebanon County suggests that large yields are possible. Water is probably hard to very hard.

[1]Onondaga Formation through Poxono Island Formation, undivided. Not studied (limited aerial extent)
[2]Not studied
[3]Hydrologic data from Becher and Root (1981) and Becher and Taylor (1982)
[4]Hydrologic data from Carswell and others (1968), Meisler (1963), Wood and MacLachlan (1978), and Royer (1983)
[5]Hydrologic data from Taylor and Royer (1981).
[6]Also occurs in the Pigeon Hills region of Adams and York Counties
[7]Hydrologic data from Royer (1983)
[8]Hydrologic data from Taylor and Royer (1981), Wood (1980a), Wood and Johnston (1964), and Johnston (1966)
[9]This area of the Beekmantown Group is physically located in the Triassic Lowland Section, but it is probably an outlier of Great Valley type rock
[10]Hydrologic data from Poth (1977), Lloyd and Growitz (1977), and Meisler and Becher (1971)
[11]Hydrologic data from Poth (1977), Lloyd and Growitz (1977), Poth (1968), and McGreevy and Sloto (1977)

System	Map unit	Description	Hydrologic characteristics
TRIASSIC	HAMMER CREEK FORMATION (Th; Thc)	Fanglomerate composed of pebbles to boulders of limestone in a matrix of red or gray sandstone or shale (Thc); pebble and cobble quartz conglomerate with red sandstone (Thcq); and reddish brown fine- to coarse-grained, quartzose sandstone and a few red shale interbeds (Th).	Median yield of domestic wells from all lithologies combined is 20 gal/min. Median yields for nondomestic wells range from 90 to 144 gal/min, the highest yields are obtained from shale and the lowest from sandstone. Hardness ranges from soft for the quartz conglomerate to hard and sometimes very hard for the limestone fanglomerate.
	NEW OXFORD FORMATION (Tn; Tnc) / STOCKTON FORMATION (Ts)	New Oxford Formation—Red mudstone and shale and fine-grained sandstone interbedded with arkosic sandstone; conglomerate and arkosic beds are common in the lower part (Tnc). Stockton Formation—Light-gray, coarse-grained arkosic sandstone; includes reddish-brown mudstone and shale.	[illegible]
ORDOVICIAN	BEEKMANTOWN GROUP[9] (Ob)	Occurs in a small area near York Springs, Adams County. Primarily white or gray marble, some of which is coarsely crystalline and veined with calcite.	Limited data are available; probably a fair to good aquifer that yields moderate to large quantities of very hard water.

CONESTOGA VALLEY SECTION[10]

System	Map unit	Description	Hydrologic characteristics
ORDOVICIAN	COCALICO FORMATION (Oco)	Bluish-black to dark gray fissile shale; purple and green shale; thin quartzite occurs near the base.	Reported yields range from 1 to 100 gal/min; about half are less than 20 gal/min. Water is probably moderately hard.
	HERSHEY AND MYERSTOWN FORMATIONS, UNDIVIDED (Ohm)	Hershey Formation—Dark gray to black, thin-bedded, argillaceous limestone. Myerstown Formation—Medium- to dark-gray, platy, medium crystalline limestone, carbonaceous at the base.	Limited areal extent, water bearing properties [illegible]
	ANNVILLE FORMATION (Oan)	Light-gray, massive, high-calcium limestone.	
	ONTELAUNEE FORMATION (Oo)	Gray, very finely to finely crystalline, partly laminated dolomite.	Limited areal extent, water bearing properties [illegible]
	EPLER FORMATION (Oe)	Gray interbedded limestone and dolomite, abundant white beds in the lower part.	Reported yields range from 1 to [illegible]; [illegible] 30 gal/min. Based on specific-capacity data [illegible] highest yielding aquifer in the Conestoga [illegible]. Water very hard, high levels of nitrate are a common problem.
	STONEHENGE FORMATION (Os)	Gray, finely crystalline limestone containing dark-gray silty laminations.	
CAMBRIAN	CONESTOGA FORMATION (OCc)	Gray, fine- to coarse-crystalline limestone, commonly contains laminations that are clayey, graphitic, or micaceous; contains basal beds of carbonate conglomerate.	Maximum reported yield is 250 gal/min. [illegible] calculated from specific-capacity data [illegible] wells should yield [illegible]. [illegible] wells exceed the limit recommended for nitrate by the Environmental Protection Agency (1975).
	RICHLAND FORMATION (Cr)	Gray interbedded limestone and dolomite, contains beds of fine conglomerate.	Reported yields of six wells range from 5 to 30 gal/min. Based on specific-capacity data these rocks are a poor source for public or industrial supplies, but are adequate for domestic use. Water is [illegible] hard and often contains high concentrations of nitrate and dissolved solids.
	MILLBACH FORMATION (Cm)	White to pinkish-gray interbedded limestone and dolomite.	
	SNITZ CREEK FORMATION (Csc)	White to pinkish-gray, interbedded limestone and dolomite, scattered beds of sandstone.	
	BUFFALO SPRINGS FORMATION (Cbs)	*Gray, argillaceous, silty, and sandy dolomite.*	
	ZOOKS CORNER FORMATION (Czc)	Gray, very finely crystalline dolomite [illegible] and sandy, contains some limestone.	Reported yields of five wells range from 3 to 105 gal/min; based on specific-capacity data this unit is a poor source for public and industrial supplies, but is adequate for domestic use. Water is very hard.
	LEDGER FORMATION (Cl)	Light-gray, coarsely crystalline dolomite.	Reported yields range from 2 to 570 gal/min, the median is 30 gal/min. Based on specific capacity data, this is one of the most productive aquifers in the physiographic section. [illegible] wells are estimated to have the potential for [illegible] 500 gal/min [illegible] County. Water is very hard; high concentrations of manganese and nitrate are an occasional problem.
	KINZERS FORMATION (Ck)	Gray, rusty-weathering shale and argillaceous to sandy limestone and dolomite.	Limited areal extent, maximum reported yield is 111 gal/min, rated as a poor aquifer for large supplies based on specific-capacity data. Water from shale is hard and water from limestone and dolomite very hard.
	VINTAGE FORMATION (Cv)	Largely gray, thick-bedded to massive, finely crystalline dolomite; upper part is primarily pure, fine grained limestone.	Limited areal extent, maximum reported yield is 300 gal/min, rated as a fair source for large supplies based on specific-capacity data. Water is hard to very hard.
	ANTIETAM FORMATION (Ca)	Fine- to medium grained phyllitic quartzite, in places bluish-pink.	Reported yields range from 3 to 40 gal/min and the median is about 5 gal/min, based on specific-capacity data this is one of the lowest yielding units in the physiographic section. Water is soft and low in dissolved solids.
	HARPERS FORMATION (Ch)	Dark-greenish gray phyllite, contains beds of green and gray quartzite, and some graywacke siltstone and graywacke.	Reported yields range from 1 to 100 gal/min and the median is [illegible] gal/min. Water is soft to moderately hard and relatively low in dissolved solids.
	CHICKIES FORMATION (Cch)	Massive, prominently bedded, white vitreous quartzite, in places black shiny slate containing numerous zones of quartzite; basal quartzose conglomerate is commonly present.	Reported yields range from 1 to 100 gal/min, about half are less than 6 gal/min. Water is soft and low in dissolved solids; high iron and manganese are an occasional problem.

PIEDMONT UPLANDS SECTION[11]

System	Map unit	Description	Hydrologic characteristics
PROBABLY LOWER PALEOZOIC	SERPENTINITE (Xs)	Dark green serpentine mottled with light green.	Limited data are available; probably yields small supplies of soft water.
	PEACH BOTTOM SLATE AND CARDIFF CONGLOMERATE, UNDIVIDED (Xpb)	Peach Bottom Slate—Blue-black slate, finely lustrous on cleavage surfaces. Cardiff Conglomerate—Greenish-gray quartz conglomerate with muscovite partings.	Limited areal extent [illegible]. Data are pumped at a rate of [illegible] gal/min [illegible] after year. Water is soft and low in dissolved solids.
	PETERS CREEK SCHIST (Xpc)	Series of light-greenish gray muscovite, chlorite, and quartz schists interbedded with quartzite.	Reported yields range from 1 to 60 gal/min, about half are 10 gal/min or less. Water is soft and low in dissolved solids, high concentrations of iron are a frequent problem.
	WISSAHICKON FORMATION (Xwm, Xww, Xwv, Xwc, Xw)	Includes the following: albite-chlorite schist (Xwc); Marburg Schist (Xwm)—bluish-gray to silvery-green, fine-grained schist; Wakefield Marble (Xww)—blue, thin bedded, crystalline limestone; metavolcanics (Xwv), and oligoclase-mica schist (Xw).	Reported yields range from 2 to 150 gal/min; the median is approximately 10 gal/min. Based on specific-capacity data, moderate to relatively large supplies are possible. Water is soft and low in dissolved solids, high iron and nitrate concentrations are a frequent problem.
PRECAMBRIAN	METAMORPHIC AND IGNEOUS ROCKS (Xpg, Xmg, md, gqm, ggd, gga, gg, gn)	Includes the following: pegmatite (Xpg), metagabbro (Xmg), metadiabase (md), quartz monzonite and quartz-monzonite gneiss (gqm); granodiorite and granodiorite gneiss (ggd); gabbroic gneiss and gabbro (gga); graphitic gneiss (gg), and granitic gneiss (gn).	Reported yields range from 2 to 70 gal/min, the median is about 10 gal/min. Water is soft and low in dissolved solids.

Geology and base map from Berg and others (1980)
Hydrology by L. E. Taylor and W. H. Werkheiser, 1980–82

James H. Dolimpio, Cartographer